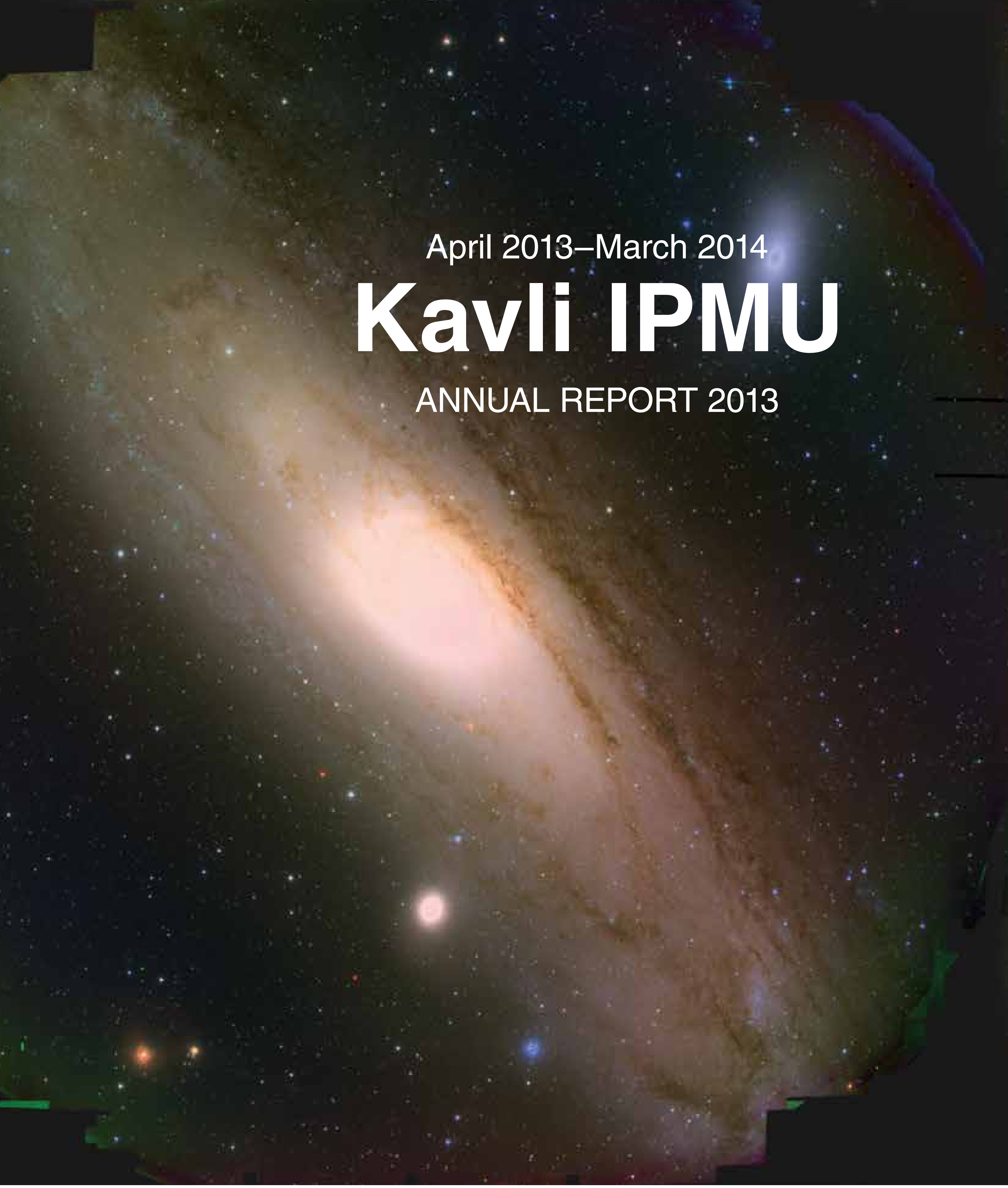

April 2013–March 2014

Kavli IPMU

ANNUAL REPORT 2013

World Premier International Research Center Initiative

THE UNIVERSITY OF TOKYO

TODIAS
東京大学国際高等研究所
TODAI INSTITUTES FOR ADVANCED STUDY

KAVLI IPMU INSTITUTE FOR THE PHYSICS AND MATHEMATICS OF THE UNIVERSE

KAVLI IPMU

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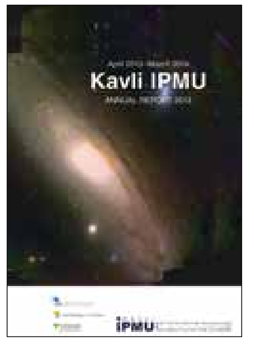
Design: aha co.,ltd.
http://www.a-ha.co.jp/

Contents



On the cover: The full view of M31 taken by HSC. The HSC mounted on the Subaru Telescope can observe an extremely wide field of view, equal to 9 times the area of the full moon. In some parts at the edge region appear to be strange color since the boundary area of the image circle is hard to process and observed area is not perfectly coinciding between the 3 bands. (Image credit: HSC Collaboration / Kavli IPMU.)

Foreword

Hitoshi Murayama
Director

It is a good time to reflect on the first seven years of our institute. The Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU) was founded seven years ago on October 1, 2007. We proposed to address five basic questions about the Universe, how it began, what it is made of, what its fate is, what its fundamental laws are, and why we exist in it. We do so by combining mathematics, physics, and astronomy, employing accelerator-based experiments, underground experiments, and observations at telescopes. This Institute literally started from scratch, but now has grown to a size of about 150 people on site including graduate students and support staff.

Overall, I believe the Institute came out to be exactly as proposed. Our unique building allows mathematicians, physicists and astronomers to be under the same roof, sharing seminars and the daily teatime. Interdisciplinary discussions have become a commonplace. The Institute is highly international; more than a half of the members are not Japanese nationals. Every member was hired anew, and the quality of the hires is clear; about 90% of the postdocs have been offered positions at other excellent institutions after their term at Kavli IPMU, and *more than a third of them are on faculty positions* by now. Our citation counts are similar to other world-leading research institutions. Thanks to several high profile papers and high international visibility, our members are invited to major conferences as keynote or summary speakers. We advertise positions internationally and attract nearly a thousand applications each year.

Many papers were written based on mutual inspiration of mathematicians and physicists. Key "interpreters" to overcome the language barrier between mathematicians and physicists played critical roles to make it possible. This is crucial to address the question "what are the fundamental laws?" The large projects proposed in the original proposal are producing fruits. The direct dark matter detection experiment XMASS was built and produced world best limits on some candidates. It is addressing the question "what is the Universe made of." The KamLAND-Zen effort produced the world best limit on neutrinoless double beta decay (this result was published in February, 2013, namely, in FY2012). Hyper Suprime-Cam (HSC) was designed, built, commissioned, and the 300-night survey was approved on the Subaru telescope, one of the largest in the world. Data from the initial few nights are being analyzed. Combined with the theoretical research by our members, they address the question "why do we exist."

We proposed Prime Focus Spectrograph (PFS) in 2009, which is now under construction. The combination of imaging survey using HSC and spectroscopic survey using PFS on the same telescope promises to be a world-leading observational program, looking into "the fate of the Universe" a trillion years from now. We are now proposing LiteBIRD satellite experiment to look for the evidence for the cosmic inflation, to address the question "how did the Universe begin?" looking back to the era when the Universe we see today was much smaller than the size of an atomic nucleus, only 10^{-37} seconds from the Beginning.

All of this progress will be lost if the institute cannot secure funding. Fortunately thanks to the strong leadership of President Junichi Hamada, the University promised to sustain our institute at some level. In addition, the Kavli Foundation donated endowment to give us flexibility. We now know we will not disappear from the map. We are looking into an even brighter future!

1 Introduction

FY 2013 marks the seventh year of the Kavli IPMU since it launched as IPMU, the Institute for the Physics and Mathematics of the Universe, on October 1, 2007. In these seven years, the Kavli IPMU has grown significantly. As seen from the annual transition statistics shown at the end of this section, the Kavli IPMU had 245 researchers (including affiliated members) and 40 administrative and research support staff members as of March 31, 2014 (the end of FY 2013). As one of the initial five WPI (World Premier Institutes Initiative) institutes founded at the same time, globalization has been one of the objectives of the Kavli IPMU. The proportion of the number of foreign researchers is an appropriate index to represent this effort, and it is 40% as of the end of FY 2013.

As a research institute addressing the fundamental questions of the Universe, the most important objective is scientific accomplishment. In these seven years, the number of papers published by Kavli IPMU researchers in refereed journals yearly has shown steady growth, as shown by the annual transition statistics. Many of these papers have been published in journals having a high impact factor. Also, many of these papers have high citation statistics. Some selected research highlights achieved in FY 2013 are given in Section 5. Although most of the scientific achievements in the early years of the Kavli IPMU were theoretical, a noteworthy feature in FY 2013 is that results have been reported from experimental and observational projects, such as XMASS, which generally need a long lead time. Another notable feature is that significant achievements in mathematics have been reported by mathematicians at the Kavli IPMU. Generally, the time scale of research in mathematics (for instance, the time needed from submission of a paper to publication) is longer than that in physics and astronomy. It seems that seven years since its launch, research in mathematics at the Kavli IPMU is now in a steady state of flourishing.

Experimental / observational projects that the Kavli IPMU has been promoting also show steady progress. A Kavli IPMU team shares the responsibility for fabricating a silicon vertex detector for the Belle 2 experiment, and this task has advanced well. Since the engineering first light of the Hyper Suprime-Cam (HSC), the new-generation prime-focus camera of the Subaru telescope, in August 2012 (see the Kavli IPMU Annual Report 2012), the HSC international collaboration has been conducting a series of performance test observations while also working on the data analysis software under the initiatives of researchers at Princeton University, Kavli IPMU, and NAOJ. The beautiful image of the Andromeda Galaxy (M31) on the cover page of this Annual Report is one of the first images processed with this data analysis software.

HSC has been developed as one of the two subprojects of the SuMIRe (Subaru Measurement of Images and Redshifts) Project, which is supported by FIRST (The Funding Program for World-Leading Innovative R&D on Science and Technology), and led by Kavli IPMU Director Hitoshi Murayama as a core researcher. Another component of SuMIRe is a multi-object spectrograph, the Prime Focus Spectrograph (PFS), which is currently in the development and instrumentation process. The PFS will share the wide field corrector of HSC, and there are plans to make a spectroscopic observation for a few million galaxies selected from the galaxy catalog provided by the HSC survey. The combination of imaging and spectroscopic galaxy data for the same region of the sky will be an extremely powerful tool for studying the mysterious nature of dark matter and dark energy.

The Kavli IPMU has concluded a number of cooperative research agreements with domestic as well as overseas institutions. In December 2013, the Kavli IPMU signed a new collaboration agreement with iTHES (Interdisciplinary Theoretical Science team) of RIKEN (the Institute of Physical and Chemical Research). iTHES is a new group launched in 2013 at RIKEN with Chief Scientist Tetsuo Hatsuda designated as Director, aiming at interdisciplinary collaboration in the theoretical sciences in different fields such as physics, material science, and biology. This is the beginning of a collaboration between the Kavli IPMU and iTHES for the development of the theoretical sciences. We note that Dr. Hatsuda is also a Visiting Senior Scientist at the Kavli IPMU since October 2010.

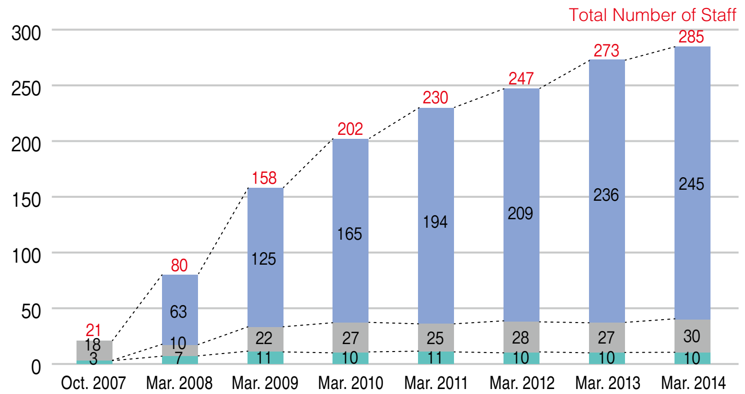
As usual, many distinguished guests visited the Kavli IPMU in FY 2013. On November 19–20, 2013, Fabiola Gianotti, former spokesperson of the ATLAS experiment that discovered the Higgs boson at CERN; on January 24–25, 2014, Lisa Randall, Professor at Harvard University; on March 26–April 3, 2014, Peter Goddard, former Director of the Institute for Advanced Study; and many other distinguished scientists visited the Kavli IPMU. Fabiola Gianotti and Lisa Randall also gave public lectures at venues in Tokyo. On November 20, 2013, Minister of State for Science and Technology Policy Ichita Yamamoto visited the Kavli IPMU and heard about the SuMIRe project from Director Murayama and other researchers. He also heard progress reports from SuMIRe collaborators at Princeton University and NASA's Jet Propulsion Laboratory via videoconference. Mr. Yamamoto also observed activities at the Kavli IPMU, such as Fabiola Gianotti's seminar, which was held on that day, laboratory work for an experimental apparatus, and joining a tea time discussion for researchers.

In FY 2013 also, the Kavli IPMU contributed to science policy, public understanding of science, promotion of science education, etc. On December 17, 2013, Director Murayama was invited to the 116th session of the Council for Science and Technology Policy (CSTP) held at the Prime Minister's official residence to give a presentation in the latter half of the session in which "The Trend of Science & Technology" was discussed. In his presentation, he explained the Kavli IPMU's research looking into the origin and fate of the Universe. A three-day winter science camp for high school students, "Open the Door to the Universe" was held at the Kavli IPMU from December 25 to 27, 2013, and twenty students selected among applicants from all over Japan took part. This was the third science camp held at the Kavli IPMU. The science camp is one of the projects supported by JST (Japan S&T Agency), providing hands-on experience to high school students. The Kavli IPMU also planned, hosted, or joined a number of outreach events; see Section 13.

A working group comprised of twelve Kavli IPMU Administrative Division staff members has received the 2013 President's Award for Operational Improvement. (The group has actually received the highest award with ¥1M support for overseas study tours as a supplementary prize.) The award has been given in recognition of the group's creation of a safety training video in English and for construction of an online system to test for the training contents. This resulted in prompt, comprehensive safety training for all newly arriving foreign researchers and a reduction of the administrative burden for such training. This kind of system is expected to be adopted university-wide, thus contributing to the further globalization of the University of Tokyo. The award was presented by President of the University of Tokyo Junichi Hamada at an awards ceremony held on December 19, 2013 at the Ito Hall on the University of Tokyo's Hongo campus. Representing the working group, Rieko Tamura received a testimonial.

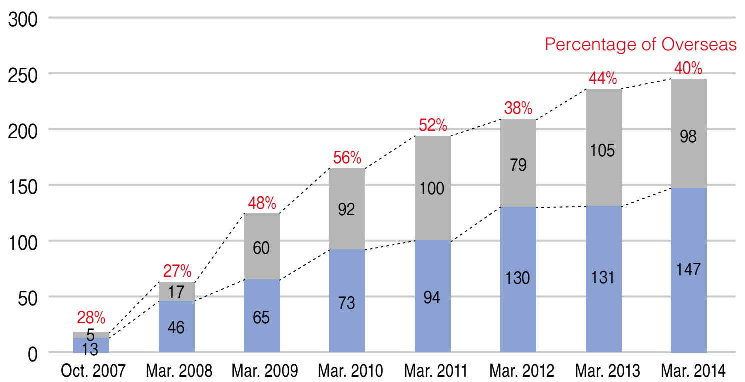
Finally, we should mention that Fred Kavli, Founder and Chairman of The Kavli Foundation passed away on November 21, 2013 at the age of 86. In 2012, the IPMU joined the Kavli family as the first Kavli Institute in Japan and the 16th in the world, and renamed it the Kavli IPMU, following an endowment from The Kavli Foundation. We will never forget Fred Kavli's generous support to the Kavli IPMU.

Number of Kavli IPMU Staff



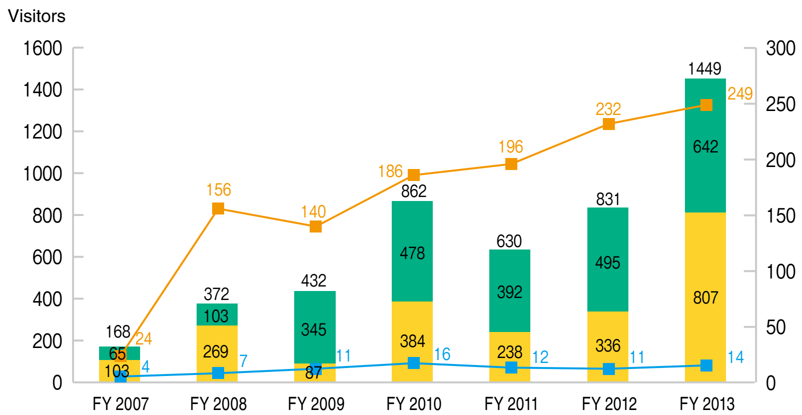
	Oct. 2007	Mar. 2008	Mar. 2009	Mar. 2010	Mar. 2011	Mar. 2012	Mar. 2013	Mar. 2014
Researchers	18	63	125	165	194	209	236	245
Research Support Staffs	0	10	22	27	25	28	27	30
Administrative Staff	3	7	11	10	11	10	10	10
Total	21	80	158	202	230	247	273	285

Number of Kavli IPMU Researchers



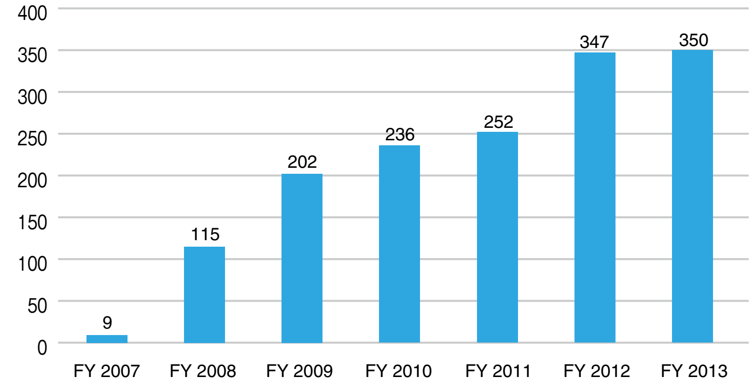
	Oct. 2007	Mar. 2008	Mar. 2009	Mar. 2010	Mar. 2011	Mar. 2012	Mar. 2013	Mar. 2014
Overseas	5	17	60	92	100	79	105	98
Domestic	13	46	65	73	94	130	131	147
% of Overseas	28%	28%	48%	56%	52%	38%	44%	40%
% of Female	0%	2%	5%	6%	5%	2%	5%	5%

Number of Research Activities

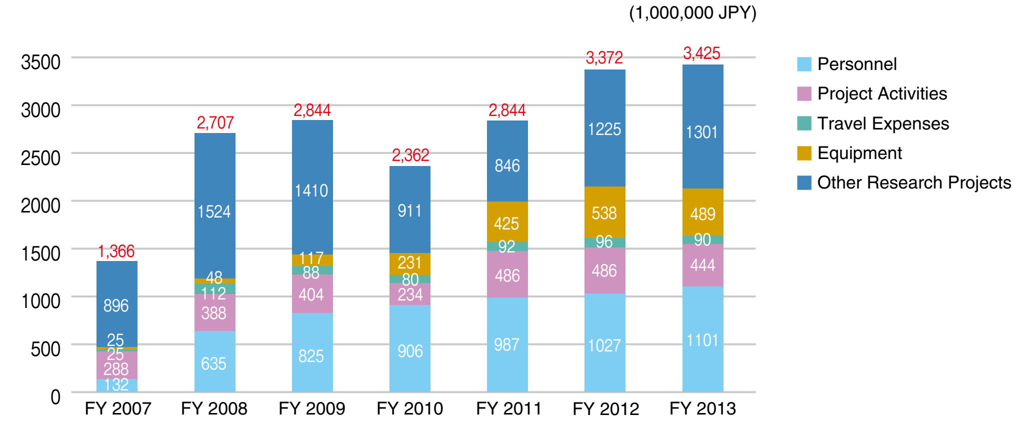


	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
Visitors (Overseas)	65	103	345	478	392	495	642
Visitors (Domestic)	103	269	87	384	238	336	807
Visitors (Total)	168	372	432	862	630	831	1449
Seminars	24	156	140	186	196	232	249
Conferences	4	7	11	16	12	11	14

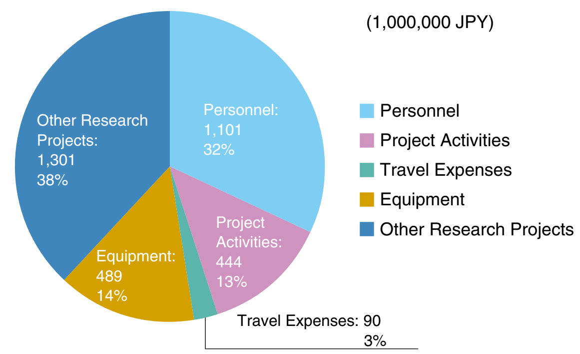
Number of Publications



Total Expenditure at Kavli IPMU



Breakdown of FY 2013 Total Expenditure



2 News & Events (April 2013–March 2014)

April

- Press release "Observationally Confirmed Supernova Explosion of a Yellow Supergiant Star"
- Press conference "*Standard Candle* Supernova Extraordinarily Magnified by Gravitational Lensing"
- Press release "Kavli IPMU Joined the POLARBEAR Cosmic Microwave Background Experiment"
- Tomoyuki Abe was awarded the 2013 MEXT's Young Scientists' Prize
- Director Murayama was elected to American Academy of Arts and Sciences
- Mini-workshop "Massive Gravity and Its Cosmological Implications"

May

- Deputy Director Yoichiro Suzuki was awarded the Giuseppe and Vanna Cocconi Prize
- Focus Week Workshop "MaNGA Focus Week"

June

- Sixth meeting of the Kavli IPMU External Advisory Committee
- Press release "Cosmic Giants Shed New Light on Dark Matter"
- Third Open Meeting for the Hyper-Kamiokande Project

July

- Press release "New Results from T2K Conclusively show Muon Neutrinos Transform to Electron Neutrinos"
- Press conference "A New View on the Origin of Dark Matter and Dark Energy—Image of M31 Heralds the Dawn of HSC—"
- Press release "Kavli IPMU and TRIUMF to Collaborate on Joint Appointed Research Position"
- Kavli IPMU School on the Future of Collider Physics
- Workshop "Cosmology with Small Scale Structure"

August

- Press release "Subaru Telescope's M31 Image Processed by the HSC Data Analysis Software"
- Press release "This is Your Galaxy: New Data Help Astronomers Explore the Hidden Milky Way" (New online public data set released by the SDSS III Collaboration)
- Workshop "Gauge and String Theory"

September

- FY2013 WPI site visit
- Workshop "Holography and QCD—Recent Progress and Challenges—"
- Symposium on Gravity and Light

October

- Toshitake Kohno was awarded the 2013 MSJ (Mathematics Society of Japan) Geometry Prize

November

- Minister of State for Science and Technology Policy Ichita Yamamoto visited Kavli IPMU
- Takaaki Kajita received the Julius Wess Award
- NNN13 International Workshop on Next Generation Nucleon Decay and Neutrino Detectors
- WPI centers jointly participated in SCIENCE AGORA 2013 and received a SCIENCE AGORA Award

December

- Director Murayama was invited to the 116th session of the Council for Science and Technology Policy (CSTP) held at the Prime Minister's official residence to give a presentation on the Kavli IPMU's research
- Press release "Marching to the Beat: Subaru's FMOS Reveals the Well-Orchestrated Growth of Massive Galaxies in the Early Universe"
- Kavli IPMU and RIKEN iTHES signed research partnership MOU
- A Working Group of Kavli IPMU Administrative Division received the 2013 University of Tokyo President's Award for Operational Improvement
- Workshop on SUSY: Model-Building and Phenomenology
- 26th *Rironkon* ("Association of Japanese Theoretical Astronomy and Astrophysics Community") Symposium
- The Third Joint Symposium of the WPI centers for high school students was held in Sendai
- Winter science camp for high school students "Open the Door to the Universe"

January

- Press release "A One-Percent Measure of the Universe" (Press release issued by the SDSS III's Baryon Oscillation Spectroscopic Survey (BOSS) Project)
- Fourth Open Meeting for the Hyper-Kamiokande Project

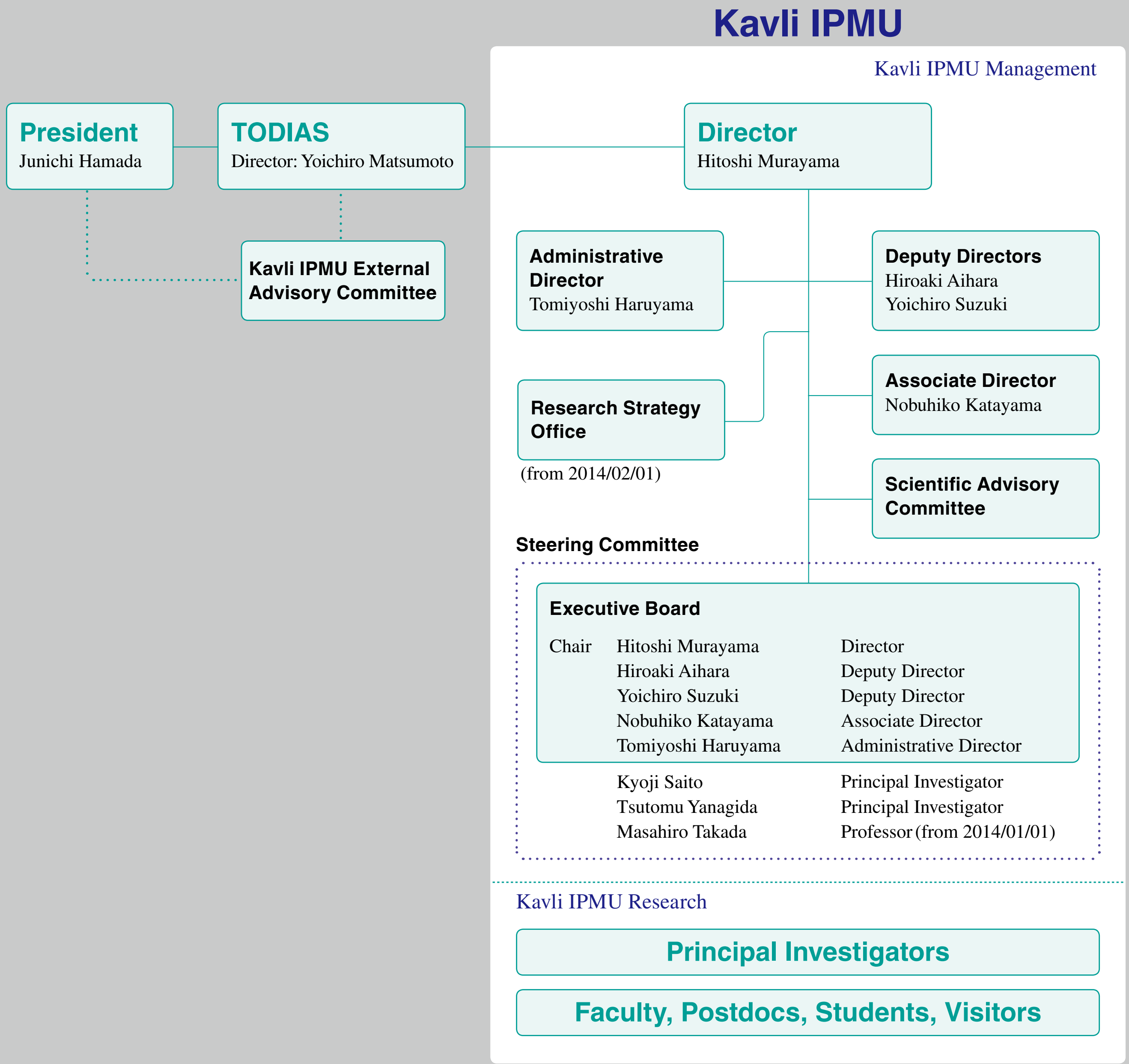
February

- J-PARC Neutrino Beam Group received the "SUWA" Award; Mark Hartz was among the prize winners
- Workshop on Primitive Forms and Related Subjects
- WPI institutes jointly participated in AAAS 2014 held in Chicago

March

- Yukinobu Toda was awarded the 2014 MSJ (Mathematical Society of Japan) Spring Prize
- Kavli IPMU-FMSP Workshop "Supersymmetry in Physics and Mathematics"

3 Organization



The Kavli IPMU has a rather unique organization. While research is conducted in a flat-structure manner with loosely defined grouping, the decision making is done in a top-down scheme under the Director's strong leadership. This scheme minimizes the administrative load for the researchers. It is also intended to maximally extract young researcher's creative and challenging minds as well as to encourage daily cross-disciplinary interactions.

The Director is appointed by the President of the University of Tokyo and reports directly to his office. The Director proposes to hire the Principal Investigators to the President. For other hiring of research staff and administrative staff, he has a complete authority. He is also solely responsible for making all other decisions. He is assisted by the two Deputy Directors, the Associate Director, and the Administrative Director. They constitute the Executive Board (EB) and regularly meet to ensure smooth operation of the Institute. The EB has direct access to the Office of the President for consultations on both scientific and administrative matters.

The Director is obliged to report the appointments of new Principal Investigators and faculty members to the Director of the Todai Institutes for Advanced Study (TODIAS). Also, to clear the university formality in faculty hiring, the decisions of the Institute have to be endorsed by the Steering Committee of the Kavli IPMU.

The Principal Investigators are world's leading scientists in their fields. They have a large autonomy in the research they conduct. They can make proposals to the Director to hire research staff at the Institute.

The Scientific Advisory Committee (SAC) gives advice to the Director on hiring scientific staff and planning scientific strategies. The members are appointed by the Director.

The External Advisory Committee (EAC), appointed by the President of the University of Tokyo, reviews annually the scientific achievement and activities of the Institute and advises the President on scientific priorities and the research activities to keep the Institute stay on the course of its objectives.

The Scientific Advisory Committee Members (March 2014)

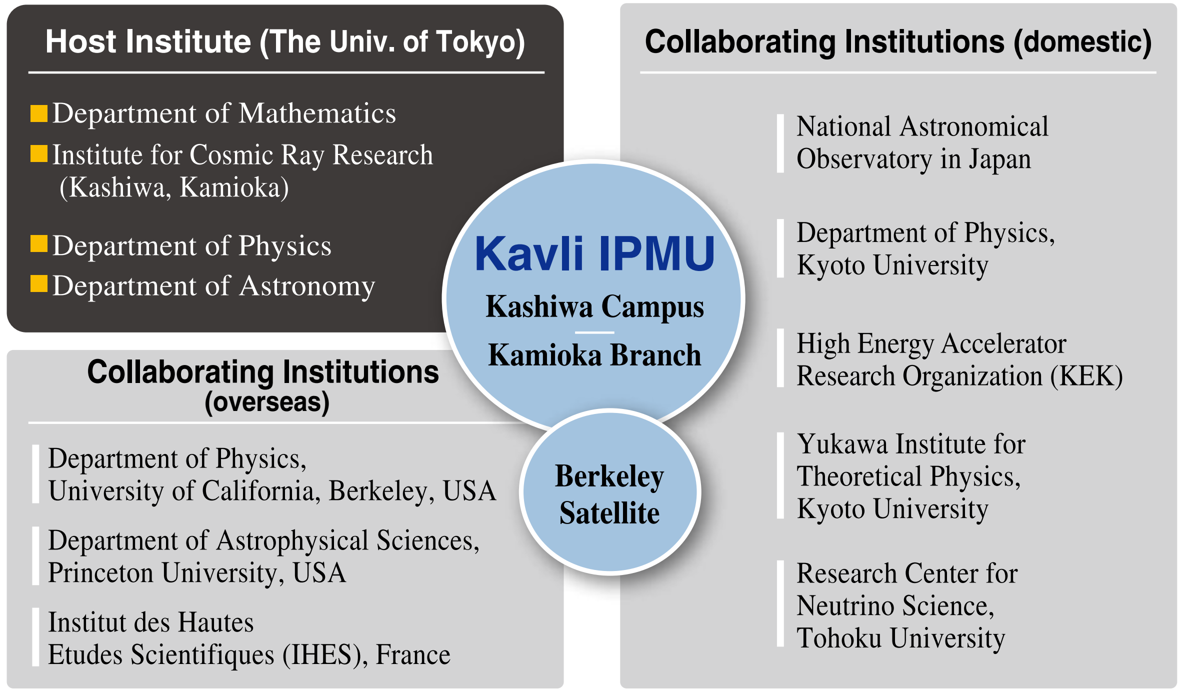
Hiroaki Aihara	U Tokyo, Physics Dept	High Energy Physics
Yoichiro Suzuki	U Tokyo, ICRR	Astroparticle Physics
Nobuhiko Katayama	Kavli IPMU	Astrophysics
Toshitake Kohno	U Tokyo, Mathematics Dept	Mathematics
Hirosi Ooguri	Caltech	Particle Theory
Kyoji Saito	Kavli IPMU	Mathematics
David Spergel	Princeton U	Astrophysics
Tsutomu Yanagida	Kavli IPMU	Particle Theory

The External Advisory Committee Members (March 2014)

John Ellis	King's College London	Particle Theory
Steven Kahn	SLAC/Stanford U; Chair	Astrophysics
Young-Kee Kim	U Chicago	High Energy Physics
Sadayoshi Kojima	Tokyo Tech	Mathematics
David Morrison	UC Santa Barbara	Mathematics and Physics
Sadanori Okamura	Hosei U	Astronomy
Nigel Smith	SNOLAB	Astroparticle Physics

On February 1, 2014, the Research Strategy Office was opened with the support of the University of Tokyo. It directly reports to the Director in order to strengthen the research activities by pursuing external funds. A university research administrator (URA) was newly hired to start the office activities.

The main laboratory building on the Kashiwa Campus provides a basis for our researchers. Even most of experimentalists who are involved in Kamioka experiments and astronomical observations spend a good fraction of their time in Kashiwa for analyzing data, sharing seminars and discussing with theorists. The Kamioka Branch is a basis for the Kavli IPMU staff members who are engaging in the underground experiments conducted at the Kamioka underground laboratory. The Berkeley Satellite, besides being a place for research, serves as a contact place to the US scientific community. We also have a close collaborative relation with several institutions both in Japan and overseas as well as with other departments within the University of Tokyo.



The Kavli IPMU holds close relations with similar research institutions in the world for encouraging exchanges in research and training of young research staff. We have signed either an agreement or a memorandum of understanding with those institutions.

Foreign institutions/consortia/programs having MOU with the Kavli IPMU

The University of California, Berkeley, Department of Physics
National Taiwan University, Leung Center for Cosmology and Particle Astrophysics (LeCosPA)
The Astrophysics Research Consortium [on the Sloan Digital Sky Survey III]
The Astrophysics Research Consortium [on the Sloan Digital Sky Survey AS3 ("After SDSS III")]
The Astrophysics Research Consortium [on the Sloan Digital Sky Survey IV]
Garching/Munich Cluster of Excellence on "The Origin and Structure of the Universe"
UNIFY (Unification of Fundamental Forces and Applications) [under the EU's Seventh Framework Program]
The Scuola Internationale Superiore di Studi Avanzati (SISSA)
The Academia Sinica Institute of Astronomy and Astrophysics of Taiwan (ASIAA) [on the SuMIRe Project]
The Intermediate Palomar Transient Factory (iPTF)
Steklov Mathematical Institute, Russian Academy of Sciences
Center for Mathematical Sciences, Tsinghua University
The Tata Institute of Fundamental Research
TRIUMF (Canada's National Laboratory for Particle and Nuclear Physics)
Deutsches Elektronen Synchrotron (DESY)

Organization

4 Staff

Kavli IPMU research staff at the 6th anniversary celebration

Director

Hitoshi Murayama

Deputy Directors

Hiroaki Aihara
Yoichiro Suzuki

Associate Director

Nobuhiko Katayama

Principal Investigators

Hiroaki Aihara (U Tokyo-Phys), High Energy Physics, Astrophysics
Alexey Bondal (Kavli IPMU & Steklov Inst), Mathematics
Kunio Inoue (Tohoku U), Neutrino Physics
Takaaki Kajita (U Tokyo-ICRR), Neutrino Physics
Stavros Katsanevas (U Paris 7), Astroparticle Physics
Toshiyuki Kobayashi (U Tokyo-Math), Mathematics
Toshitake Kohno (U Tokyo-Math), Mathematics
Hitoshi Murayama (Kavli IPMU & UC Berkeley), Particle Theory, Cosmology
Masayuki Nakahata (U Tokyo-ICRR), Astroparticle Physics
Mihoko Nojiri (KEK), Particle Theory
Ken'ichi Nomoto (Kavli IPMU), Astronomy
Hirosi Ooguri (Caltech), Mathematics, String Theory
Kyoji Saito (Kavli IPMU), Mathematics
Henry Sobel (UC Irvine), Astroparticle Physics
David Spergel (Princeton U), Astrophysics
Naoshi Sugiyama (Nagoya U), Cosmology
Yoichiro Suzuki (U Tokyo-ICRR), Astroparticle Physics
Tsutomu Yanagida (Kavli IPMU), Particle Theory

Faculty Members

Tomoyuki Abe, Mathematics
Alexey Bondal, Mathematics
Kevin Bundy, Astronomy
Masataka Fukugita, Astrophysics
Mark Hartz, Neutrino Physics (from 2013/06/16)
Simeon Hellerman, String Theory
Takeo Higuchi, High Energy Physics
Kentaro Hori, String Theory
Chang Kee Jung, High Energy Physics (till 2013/08/31)
Hiroshi Karoji, Astronomy (SuMIRe Project)
Nobuhiko Katayama, Astrophysics
Satoshi Kondo, Mathematics
Alexandre Kozlov, Neutrino Physics
Alexie Leauthaud, Astrophysics
Keiichi Maeda, Astronomy (till 2013/08/31)
Kai Martens, Astropharticle Physics
Shigeki Matsumoto, Cosmology
Todor Milanov, Mathematics
Surhud More, Astronomy (from 2014/03/01)
Shinji Mukohyama, Cosmology
Hitoshi Murayama, Particle Theory, Cosmology
Ken'ichi Nomoto, Astronomy
Masamune Oguri, Cosmology (SuMIRe Project; till 2013/08/15)
Kyoji Saito, Mathematics
John Silverman, Astronomy
Hajime Sugai, Astronomy (SuMIRe Project)
Shigeki Sugimoto, String Theory
Naotaka Suzuki, Astronomy (from 2013/09/16)
Masahiro Takada, Cosmology
Naoyuki Tamura, Astronomy (SuMIRe Project)
Yukinobu Toda, Mathematics
Mark Vagins, Astroparticle Physics
Taizan Watari, String Theory
Masahito Yamazaki, String Theory (2013/06/01–08/31)
Tsutomu Yanagida, Particle Theory
Naoki Yasuda, Astronomy

Postdoctoral Researchers

Hanindyo Kuncarayakti, Astronomy (JSPS Fellow; till 2013/07/31)
Amir Babak Aazami, Mathematical Physics
Melina Bersten, Astronomy
Jyotirmoy Bhattacharya, String Theory
Biplob Bhattacherjee, Particle Theory
Yu-Chieh Chung, String Theory
Tanmay Neelesh Deshpande, Mathematics
Richard Eager, Mathematical Physics
Brian Feldstein, Particle Theory (till 2013/09/30)
Gaston Folatelli, Astrophysics
Mitsutoshi Fujita, String Theory (JSPS Fellow)
Ahmet Emir Gumrukcuoglu, Cosmology (till 2013/09/30)
Ran Huo, Particle Theory (from 2013/09/01)
Ivan Chi-Ho IP, Mathematics
Tadashi Ishibe, Mathematics (JSPS Fellow, Komaba)
Miho N. Ishigaki, Astronomy (JSPS Fellow)
Sho Iwamoto, Particle Theory (JSPS Fellow)
Kunio Kaneta, Particle Theory (JSPS Fellow)
Ilya Karzhemanov, Mathematics (from 2013/11/01)
Tirasan Khandhawit, Mathematics (from 2013/09/01)
John Fotis Kehayias, Particle Theory
Claire Nicole Lackner, Astronomy
Changzheng Li, Mathematics
Chunshan Lin, Cosmology
Jing Liu, Astroparticle Physics
Jonathan Maltz, String Theory (from 2013/09/16)
Lluis Marti Magro, Astroparticle Physics
Charles Milton Melby-Thompson, String Theory
Rene Meyer, String Theory
Ryo Namba, Cosmology (from 2013/09/01)
Nobuhiko Okabe, Astronomy (from 2013/09/01)
Teppei Okumura, Cosmology (from 2014/01/01)
Anupreeta Sadashiv More, Astronomy (JSPS Fellow)
Surhud More, Astronomy (till 2014/02/28)
Satyanarayan Mukhopadhyay, Particle Theory
Yu Nakayama, String Theory (from 2013/09/01)
Katsuyuki Naoi, Mathematics
Ryoichi Nishio, Particle Theory (till 2013/09/30)
Haruki Nishino, Cosmology
Atsushi Nishizawa, Astronomy (SuMIRe Project)
Takaya Nozawa, Astronomy (JSPS Grant)
Myeonghun Park, Particle Theory (from 2013/10/01)
Daniel Michael Pomerleano, Mathematics
Robert Michael Quimby, Astronomy
Mauricio Andres Romo Jorquera, String Theory
Wiphu Rujopakarn, Astronomy (from 2014/03/16)
Shun Saito, Cosmology
Tomoki Saito, Astronomy (SuMIRe Project)
Cornelius Schmidt-Colinet, String Theory
Kai Ruven Schmitz, Particle Theory
Malte Schramm, Astronomy
Andreas Schulze, Astronomy (from 2013/10/01)
Yefeng Shen, Mathematics (from 2013/06/01)
Charles Martin Siegel, Mathematics
Charles Steinhardt, Astronomy (till 2013/08/31)
Norihiro Tanahashi, Cosmology (JSPS Fellow)
Valentin Tonita, Mathematics
Yue-Lin Sming Tsai, Particle Theory (from 2013/10/01)
Shunsuke Tsuchioka, Mathematics (JSPS Fellow)
Benedetta Vulcani, Astronomy
James Michael Wallbridge, Mathematics (from 2013/08/01)
Yi Wang, Cosmology (till 2013/10/31)
Marcus Werner, Mathematical Physics
Simon Wood, Mathematics (JSPS Fellow; till 2013/11/29)
Norimi Yokozaki, Particle Theory (JSPS Fellow)

Support Scientists

Steven Jeffery Bickerton, Astronomy (SuMIRe Project)
Tomoko Iwashita, High Energy Physics (Belle II; from 2013/11/16)
Masahiko Kimura, Astronomy (SuMIRe Project; Stationed at ASIAA)
Atsushi Shimono, Astrophysics (SuMIRe Project)

Joint Appointments

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Alexander Kusenko, Particle Theory (2013/10/11–12/09)
Hitoshi Murayama (UC Berkeley), Particle Theory, Cosmology
Serguey Petcov, Particle Theory (2013/11/01–11/22, 2014/02/20–04/04)
Tatsu Takeuchi, Particle Theory (2013/1/04–05/08, 06/03–08/16)
Edwin Turner, Astronomy, Astrophysics (2013/05/07–05/17, 06/10–06/21, 10/17–11/01, 2014/01/20–01/31)

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Bruce Berger (Colorado State U), Neutrino Physics
Raphael Bousso (UC Berkeley), Cosmology
Andrew Bunker (U Oxford), Astronomy
Scott Huai-Lei Carnahan (Tsukuba U), Mathematics
Patrick Decowski (NIKHEF), Neutrino Physics
Mamoru Doi (U Tokyo-Astron), Astronomy
Yuri Efremenko (U Tennessee), Neutrino Physics
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Andrea Ferrara (S.N.S. Pisa), Astronomy
Brian Fujikawa (LBNL), Neutrino Physics
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5 Research Highlights

5.1 Langlands correspondence for function fields and *p*-adic cohomology theory

Tomoyuki Abe

Number theory and Galois

One of the ultimate goals of number theory is to understand the behavior of solutions of algebraic equations. In Babylonian age, mathematicians already knew formulae to solve certain quadratic equations. Even though this kind of techniques may have been found by practical needs, people were attracted by solving algebraic equations of higher degree in itself. Long after the discovery of solution of quadratic equations, in 16th century, Italian mathematicians[1] found an explicit formula to solve cubic equation, and immediately after, that for quartic equation. In the course of the finding, they inevitably needed to deal with square root of negative numbers. This was quite uncomfortable at that time, but later led to the notion of complex numbers. Without surprise, people stepped forward to quintic equation. However, the structure seemed to be much more complicated than equations that mathematicians had been treated, and all the attempts ended up in vain.

Breakthrough was achieved by E. Galois, who introduced the notion of "groups" and described the behavior of algebraic equations in terms of a certain group, now called the *Galois group*. By analyzing the structure of the group, he succeeded in concluding that solutions for quintic equations cannot be written in general by means of roots and four basic arithmetic operations.[2]

Class field theory and Langlands correspondence

Galois groups contain plenty of arithmetic information, and modern arithmetic tries to "understand" this group. However, how can we say that we understand the group? One of such ways is to describe it in another way. First achievement in this direction is the celebrated class field theory, developed by Hilbert, Takagi, Furtwängler, Artin, Hasse, *and others*, in early 20th century. They described the abelianized Galois group of a number field K in terms of group of certain functions, called the idèle class group, as follows:

$$\mathrm{Gal}(\bar{K}/K)^{\mathrm{ab}} \cong \mathbb{A}_K^{\times}/K.$$

However, it is not fully satisfactory since a lot of information is lost by abelianization. It is not straightforward to generalize the class field theory to non-abelian case, but Langlands' profound insight led him to propose a fabulous "equivalence" of seemingly unrelated two mathematical objects, now called the *Langlands correspondence*. This is a correspondence between representations of Galois group and "automorphic representations," a representation theoretic generalization of modular forms (i.e., holomorphic functions with certain strong symmetry).

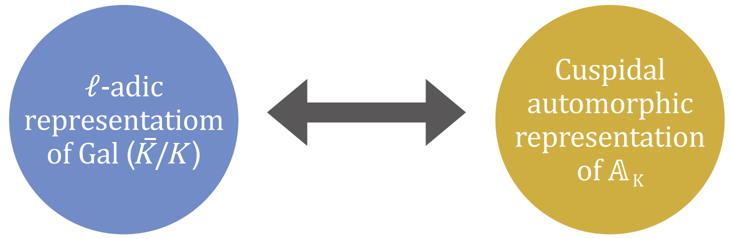
A part of the high non-triviality of the correspondence may be seen from the fact that it is not functorial contrary to most of mathematical theories. Moreover, the resolution of Fermat's last theorem by A. Wiles can be seen as an establishment of a very small part of it. This correspondence grew into one of the *Leitmotiv* of modern mathematics, not only arithmetic.

1. Formula is due to Scipione del Ferro and Tartaglia, published by Gerolamo Cardano.
2. Strictly speaking, this fact was first proven by N. Abel but he did not reached to the notion of groups.

Function fields and Langlands correspondence

Even though the main goal of arithmetic is to understand number fields, it is observed that function fields of one variable over finite fields behave quite similarly. Function fields have an advantage that we can use "geometric methods," for instance cohomology theories. Not only making us easier to treat the field, this perspective enables us to "export" ideas of arithmetic to, say, complex geometry. In fact, "geometric Langlands correspondence," which is a certain correspondence of sheaves on Riemann surfaces, was formulated under this spirit. It seems geometric Langlands correspondence has some relation with S-duality, which is a physical theory, but we do not go into further details in this report.

V. Drinfeld proposed a program to establish the Langlands correspondence for function fields and carried it out in certain cases. He was awarded Fields medal by this contribution. The method was expanded by L. Lafforgue who finalized Drinfeld's program and achieved to establish the correspondence for function fields with full generality. He was awarded Fields medal as well. We can summarize the correspondence in the following picture:



Here, K is a "function field" of characteristic $p \neq 0$ (*e.g.*, $\mathbb{F}_p((t))$), and ℓ is a prime number *different from p*.

p-adic cohomology theory and Langlands correspondence

In the previous paragraph, we took a prime number ℓ which was different from the characteristic of the function field K. It is known that p-adic representation of $\mathrm{Gal}(\bar{K}/K)$ is generally quite complicated, and we are not able to hope for the correspondence. Do we have some other mathematically meaningful object that should replace ℓ-adic representations and describe the p-adic behavior of K?

Answering to this question is my main achievement this year (IPMU13-0191 and IPMU13-0192), or since I have come to Kavli IPMU. Namely, I established a Langlands type correspondence for another type of local system called "isocrystal." The existence of such correspondence was conjectured by P. Deligne in one of the most influential papers in mathematics (P. Deligne, *La Conjecture de Weil II*, Publ. Math. IHES 52, pp.313-428): ***"Conjecture (1.2.10). — Soient*** X ***normal connexe de type fini sur*** $\mathbb{F}p$***, et …… (vi) Pour*** λ ***divisant*** p***, on espère des petits camarades cristallins."*** Isocrystals are, roughly speaking, systems of p-adic differential equations, and the definition is completely different from that of ℓ-adic local systems, in other words, ℓ-adic representations of the Galois group. Therefore, it is a big surprise to have such a correspondence.

For a proof, it had been observed by experts that analogous method of Lafforgue in p-adic cohomology theory might be applicable. However, there had been a lot of obstacles to carry this out, mainly by the incompleteness of p-adic cohomology theory. My work was done by constructing a six functor formalism *à la* Grothendieck for p-adic cohomology theory, with which the seeking for "good p-adic cohomological framework," after Monsky and Washnitzer who first defined the p-adic cohomology in 60s, has been completed. In the construction, I used the theory of arithmetic $\mathcal{D}$-modules set up by P. Berthelot as a basic tool. Thanks to works of Berthelot, K. Kedlaya, D. Caro and others, six functor formalism had been constructed at least "locally." My work is, thus, to globalize this construction. It turned out that this globalization process is quite formal, and the techniques can be used for other reasonable cohomology theories. Combining with my previous works on the product formula with A. Marmora, and the theory of weights with Caro, the proof concludes as Drinfeld's or Lafforgue's work.

5.2 Gromov-Witten invariants and representations of infinite-dimensional Lie algebras

Todor Milanov

The notion of a manifold is central in both Mathematics and Physics. The first example is the Euclidean space whose geometry was studied since ancient times. It was realized in the 18th and the 19th century that for many problems in Mathematics and Physics, such as solving a system of algebraic equations, or various problems in classical mechanics, it is convenient to build new space whose building blocks are Euclidean boxes. Mathematics has always been driven by our sense of beauty. As mathematicians we have always wanted to work on problems that appeal to us. I think that some of the most interesting problems in Mathematics involve understanding the geometry of some manifold and in some sense all other areas, such as number theory, algebra, or analysis can be viewed as tools to be used or to be developed for the purposes of geometry.

My main interest is to compute the Gromov-Witten (GW) invariants of a projective manifold X. The problem can be formulated also via the topological string model in physics. The latter is a specific toy model that describes the motion of a closed string in X. The GW invariants can be interpreted as the probability that certain events will occur. Since the trajectory of a string is a surface, mathematically the GW invariants can be interpreted as counting surfaces in X satisfying various incidence constraints. Since we can impose many incidence constraints the GW invariants of X are usually infinitely many and finding a way to describe them is not easy at all.

It was discovered recently by several people that the GW invariants of a manifold X that has semi-simple quantum cohomology satisfy the local Eynard-Orantin recursion. In fact, I was also part of this discovery, which is the content of my paper "*The Eynard-Orantin recursion for the total ancestor potential*, IPMU12-2014" (accepted in Duke Math. J.). In the beginning of 2013 I managed to make the first step in extending the recursion from local to global. As an application, in my paper "*Analyticity of the total ancestor potential in singularity theory*, arXiv1303.3103" (Adv. in Math. **255** (2014) 217-241) I proved a conjecture of Givental about the analyticity of the total ancestor potential as a function on the deformation parameters. I think that my result can be generalized even further in a sense that it should be possible to find a global Eynard-Orantin recursion. This is expected to be equivalent to characterizing the GW invariants via the representation theory of vertex algebras in the same way as in my previous work with B. Bakalov "*W-constraints for the total ancestor potential for simple singularities*, Compositio Math. **149** (2013) 840-888."

In the 2nd half of 2013 I worked on yet another way to compute GW invariants. Namely, if X has semi-simple quantum cohomology, then the invariants can be organized into a generating function, which is a solution to an integrable hierarchy of evolutionary partial differential equation. This construction is due Dubrovin and Zhang, modulo certain technical issue, which was resolved by Buryak-Shadrin-Posthuma. While Dubrovin and Zhang are using Hamiltonian formalism, I am pursuing a different direction, which relies on the representation theory of vertex algebras. The goal is to construct Hirota bilinear equations for the generating function. In collaboration with Y. Shen and H.-H. Tseng I managed to solve this problem when X is a 1-dimensional Fano orbifold: "*Gromov-Witten theory of Fano orbifold curves and ADE-Toda Hierarchies*, IPMU14-0013". I think that our method should work for all 1-dimensional orbifolds that have semi-simple quantum cohomology. Moreover, this approach will establish a very interesting connection between the generalized Kac-Moody Lie algebras and orbifold GW invariants. It is worth noting that for the general case, I discovered a connection to K-theory of X, which allows me to compute the vertex operators for any manifold X. It turns out that in dimension more than 1, the vertex operators depend on the values of the Riemann's zeta function. This explains to some extent why the approach with Hirota bilinear equations becomes very difficult in dimension more than 1. At the same time, it looks quite important to continue my work in this direction for targets of dimension more than 1.

5.3 Mirror symmetry on primitive forms

Kyoji Saito

We report developments that took place at IPMU in 2013 on LG-LG mirror symmetry using primitive forms, inspired by physics.

We start with a historical description of primitive forms. One of my main research interests is the study of period integrals of differential forms of complex variables, since they often reveal unexpected deep connections between different areas of mathe- matics. The classical example of a period integral is the logarithmic integral $\int dx/x$, where the inverse function of its indefinite integral $y = \int^x dx/x$ is the exponential function $x = e^y$, having $2\pi\sqrt{-1} = \oint dx/x$ as the fundamental period. Similarly the inverse of the integral $\int dx/\sqrt{1-x^2}$ defines the trigonometric function, having 2π as its fundamental period. Further examples are the elliptic integrals of the first kind, say $\int dx/\sqrt{4x^3-g_2x-g_3}$ or $\int dx/\sqrt{x^4+k_1x+k_2}$, whose inverse functions are doubly periodic elliptic functions (with two basic periods) studied by many mathematicians including Euler, Abel, Jacobi and Gauss.

In a modern understanding, we regard these integrated differential forms as de Rham cohomology classes of punctured Riemann surfaces of genus 0 or 1, and the period integrals as their evaluations by homology classes. Then, the Abel-Jacobi theory of period integrals over Riemann surfaces is the higher- genus generalization of the classical theory, one of the most beautiful achievements of 19th century mathematics. Furthermore, the cohomological formulation of period integrals on high dimensional varieties, called the (mixed) Hodge theory, is one deep subject in 20th century mathematics.

In spite of those general formulations, I was still attracted by the classical (logarithmic, trigonometric, and elliptic) integral theories, since they seem to keep structures escaped from the modern formulation. Namely, in those classical theories, the number μ of linearly independent cycles, on which we integrate periods (i.e., μ=1 for logarithmic and triangular integrals and μ=2 for elliptic integrals) is equal to the number of parameters in the integrals, i.e., two parameters g_2, g_3 or two parameters k_1 and k_2 for the elliptic integrals (they are hidden in logarithmic and trigonometric cases). Then, one defines the period map by associating to each μ-tuple parameter values μ-tuple period integral values (for instance, $(g_2, g_3) \mapsto (\omega_1, \omega_2)$ with $\omega_i = \oint_{\gamma_i} dx/\sqrt{4x^3-g_2x-g_3}$), where γ_i ($i=1, \cdots, \mu$) are linearly independent 1-cycles. The map is not only equi-dimensional by definition, but rather, it is locally homeomorphic. Even if the period map is globally not 1:1 but multi-valued, its inverse map from the period domain to the parameter space is a well-defined unique valued map which is invariant under the monodromy group action. Then, the coordinate components of the inverse map are given by Eisenstein series (for instance, $\frac{1}{60} g_2 = \sum_{m,n} (m\omega_1+n\omega_2)^{-4}$, $\frac{1}{140} g_3 = \sum_{m,n} (m\omega_1+n\omega_2)^{-6}$ in the elliptic integral case).

How could such beautiful phenomena happen? As we discussed already, the number μ of independent cycles is equal to the number of deformation parameters in the integral. But, let us see a deeper reason which justifies the name *primitive form* later: some readers may notice the following puzzle "If there exist μ linearly independent homology cycles, say γ_i ($1 \le i \le \mu$), then there also exist μ linearly independent de Rham cohomology classes. In the above definition of the period map, however, we integrated only a single differential form, say ζ, but not all μ classes. Why not integrate all of them?" The answer is the following: consider μ classes of differential forms obtained by covariantly differentiating ζ by the μ parameters, say $\nabla_j \zeta$ ($1 \le j \le \mu$). It turns out that they form a basis of the de Rham cohomology group. That is, we obtain all μ independent period integrals by differentiating the single period integral $\oint \zeta$ by the parameters, due to a formula $\partial_j \oint \zeta = \oint \nabla_j \zeta$ and non-zero Jacobian det $(\partial_j \oint_{\gamma_i} \zeta)_{ij=1}^{\mu} \neq 0$. Let us call this distinguished property of ζ the *primitivity*.

Research Highlights

Are the logarithmic, trigonometric, and elliptic integrals the only lucky cases of such primitive integrals? In the early ’70s, guided by such considerations, I researched the literature and found that E. Picard (1881) and G. Shimura (1964) were studying some particular period integrals having the same primitivity property as the above. On the other hand, I observed that the theorem of J. Milnor (1970) says that the number μ of linearly independent vanishing cycles for an isolated critical point of a holomorphic function is equal to the number of deformation parameters (unfoldings, R. Thom 1975) of the critical point. It should be the first step toward primitivity. Actually, the logarithmic and trigonometric integrals correspond to critical points of type A_1 and the two elliptic integrals correspond to critical points of type A_2 and B_2. The Picard and Shimura cases correspond to other critical points.

Thus, it is natural to ask (1) to find a particular de Rham cohomology class ζ satisfying the “primitivity” on the universal unfolding of any isolated critical point, and (2) to find an intrinsic flat linear coordinate system on the deformation parameter space of the critical point so that the coordinate components of the inverse map of the period map give a new class (which we may call primitive) of automorphic forms. For simple singularities, I found answers shortly later (1979) (1) that the natural weighted homogeneous volume form (≃Kostant-Kirillov form) satisfies the primitivity, and (2) the flat metric J on the deformation parameter space ($\simeq \mathfrak{h}/W$), is given by the covariant derivative $\nabla_D I$ of the Killing form I with respect to the lowest degree vector field D. Solutions of Levi-Civita connection of the flat metric J define the *flat coordinate system* on $\mathfrak{h}/W$ (for instance, g_2, g_3 in the elliptic integrals are flat coordinates). This structure on $\mathfrak{h}/W$ is called the *flat structure*, which is later on axiomatized as a *Frobenius manifold structure* (Dubrovin 1996).

Guided by this case, I came to the general concept of a primitive form (1980, 1983) enjoying (1) and (2) (actually, (2) is a consequence of (1) by imposing “more conditions” on ζ as follows). Namely, a primitive form is a top degree class in the semi-infinitely filtered relative de Rham cohomology module on a universal unfolding F of a function having an isolated critical point, and is defined by a system of higher residue bilinear equations, asking 1. Primitivity: the first order derivatives of ζ by deformation parameters span the first splitting factor of the filtration (by shifting, we obtain a full-splitting of the filtration), 2. Orthogonality: the splitting factors are orthogonal to each other, 3. Holonomicity: the second order derivation of ζ by the deformation parameters and by the Fourier dual variable of F remains inside two splitting factors, 4. Homogeneity. The flat structure on the deformation parameter space is an immediate consequence of these conditions.

It turns out that the theory of primitive forms for a function F is relevant in the complex geometric (B-model) aspects of N=(2,2) supersymmetric LG (Landau-Ginzburg) theory in physics, having F as its superpotential (K. Hori). The theory has therefore become a common subject of physicists and mathematicians in Math-String seminar at IPMU. The dualities between different string models in physics give strong non-perturbative means to calculate the partition functions. For instance, Witten showed that the Landau-Ginzburg model and the sigma-model on a Calabi-Yau manifold give different phases of the same physics. The mirror symmetry (worked out by physicists K. Hori, C. Vafa, cf. Kontsevich, Yau-Zaslov-Strominger) is one of the dualities, which has had a strong impact on mathematics, since it predicts an unexpected duality between complex geometry and symplectic geometry. We explain below new developments in this subject, which took place at IPMU in the last year, and confirmed the LG-LG mirror symmetry using primitive forms.

According to physics, primitive form theory is mirror dual to the symplectic geometric (A-model) theories such as Gromov-Witten theory on a compact Kaehler manifold or Fan-Jarvis-Ruan-Witten theory on a Landau-Ginzburg orbifold (2007, 2013). A mathematically rigorous formulation of the LG-LG mirror symmetry conjecture claims the coincidence of the total potential function obtained from a primitive form for F and the generating function of FJRW invariants for the dual function F^T. Precisely, a primitive form induces a flat (Frobenius) structure and its (genus 0) pre-potential on the deformation parameter space of F. From that data, higher-genus potential is reconstructed on the generic point of the parameter space (Givental, Teleman). There were still difficult problems remaining: 1. The higher-genus potentials given by Givental needed to be extended to the entire deformation space, 2. We have had neither an explicit formula nor any means to analyze primitive forms except for simple or simply elliptic singularities (for which cases, see the works FJRW ’07, Krawitz-Shen ’11, Milanov-Shen ’12). Both problems were solved in the last year at the Kavli IPMU.

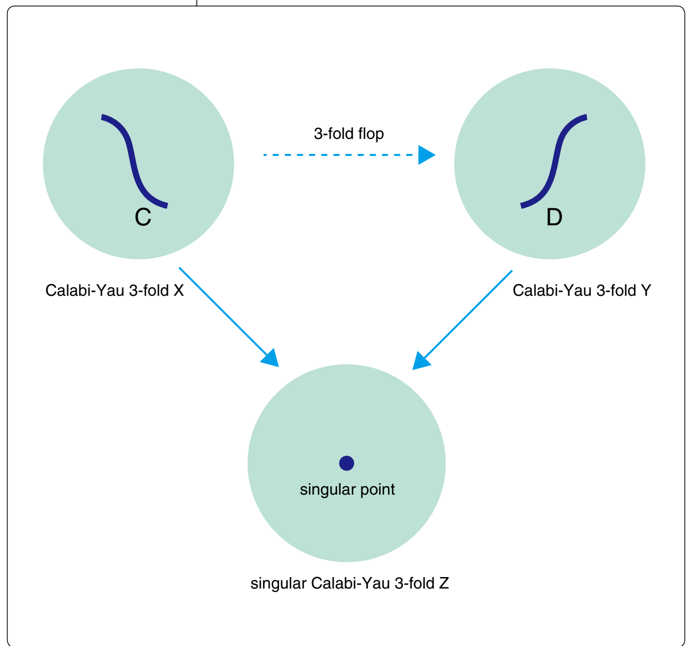
T. Milanov (Adv. in Math. **255** (2014)) proved that a semisimple Frobenius structure satisfies a local Eynard-Orantin (EO) recursion. As an application, he proved the conjecture of Givental on the analytic extendability of the total ancestor potential in whole deformation parameter space. This gives an answer to the problem 1. In a workshop at IPMU (2012), S. Li presented the idea to approach higher genus formula by heat kernels. This inspired a collaboration of K. Saito with S. Li and C. Li, where they developed a new approach to primitive forms that relies on polyvector fields. Furthermore, using the idea of Barannikov-Kontsevich, they developed the perturbative construction of primitive forms, in particular, explicit formulae for all weighted homogeneous singularities (arXiv:1311.1659). This gives an answer to the problem 2. Then, jointly with Y. Shen, an expert in FJRW theory at IPMU, they confirmed that the LG-LG mirror symmetry holds including negatively weighted deformation parameter (arXiv:1405.4530). It also shows that the 4th derivative of the pre-potential w.r.t. flat coordinates, corresponding to 4-points correlators in FJRW theory, determines the whole structure. The method is quite general, confirming the LG-LG mirror symmetry; however, the underlying geometric reasons are still hidden and should be the next target of research.

5.4 Flops and S-duality conjecture

Yukinobu Toda

One of my research results in the year 2013 is to prove a flop transformation formula of Donaldson-Thomas (DT) invariants counting two dimensional torsion sheaves on Calabi-Yau 3-folds, and give its application.

In 1998, Thomas introduced the invariants counting stable coherent sheaves on Calabi-Yau 3-folds, as a holomorphic analogue of Casson invariants on real 3-manifolds. It is also a higher dimensional analogue of Donaldson invariants on 4-manifolds, and a mathematical framework of BPS state counting in string theory. If we focus on the DT invariants counting rank one stable sheaves, they count curves on Calabi-Yau 3folds. In 2004, Maulik-Nekrasov-Okounkov-Pandharipande proposed a conjecture relating rank one DT invariants and Gromov-Witten invariants. Since then, there have been lots of progress on the study of rank one DT invariants, especially using wall-crossing formula in the derived categories of coherent sheaves. For instance, in 2008-2009, I proved (a version of) rationality conjecture of the generating series of rank one DT invariants, Pandharipande-Thomas conjecture relating rank one DT invariants and stable pair invariants, and a flop transformation formula of rank one DT invariants.



In string theory, rank zero DT invariants (i.e., counting two dimensional torsion sheaves on Calabi-Yau 3-folds) are also important as they are related to black hole entropy. In 2007, Denef-Moore predicted a formula relating rank zero DT invariants and Gromov-Witten invariants. Since these invariants count different kinds of geometric objects, this is an interesting mathematical prediction. In order to give a mathematical proof of Denef-Moore's conjecture, it is necessary to show that the generating series of rank zero DT invariants have a modular invariance property, or more precisely, they are (almost) Jacobi forms. This is interpreted as a 3-dimensional analogue of Vafa-Witten's S-duality conjecture in string theory.

In mathematics, there are few works studying rank zero DT invariants. In my paper '*Flops and S-duality conjecture,* arXiv:1311.7476,' I proved the flop transformation formula of the generating series of rank zero DT invariants under 3-fold flops. Here a 3-fold flop means that first contracting a rational curve C on a Calabi-Yau 3-fold X to a singular Calabi-Yau 3-fold Z, and then obtaining another Calabi-Yau 3-fold Y by blowing up Z in another way. (See the Figure.) The error term of the flop formula is described by the Dedekind eta function and the Jacobi theta function, and, in particular, it is a Jacobi form. This result gives an evidence of a 3-fold version of S-duality conjecture, and an analogue of a blow-up formula for the S-duality conjecture on algebraic surfaces by Yoshioka, Gottsche and Li-Qin.

Applying the above flop transformation formula, I also proved that the generating series of Euler characteristics of Hilbert schemes of points on surfaces with at worst A type singularities is a modular form. This result is written in '*S-duality for surfaces with A_n type singularities*, arXiv:1312.2300.' So far many interesting mathematical structures have been found on the Hilbert schemes of points on non-singular surfaces. However Hilbert schemes of points on singular surfaces have not been expected to have such structures before the above result. The above result indicates the contrary, and further study of them are desired.

5.5 The nonlinear sigma model: a new paradigm for physics beyond the Standard Model

Simeon Hellerman

The Standard Model of particle physics is the most accurate known description of all known matter and its non-gravitational interactions. Even with the enormous experimental data sets generated by the Large Hadron Collider at CERN, there are essentially no statistically significant deviations observed from the Standard Model's predictions. This is particularly striking, given that the LHC is probing energy scales an order of magnitude or higher than the Standard Model was originally formulated to describe.

There are nonetheless many peculiar features of the Standard Model that appear arbitrary or contrived. The focus of 'Beyond Standard Model' (BSM) model-building is to embed the Standard Model into a larger theory, applicable at higher energies, that explains these apparently contrived features in terms of a more natural structure. The earliest and still important paradigm of BSM model-building has been the concept of a Grand Unified Theory (GUT).

A GUT is a theory in which the forces of the standard model—the $U(1)$ of electromagnetism, the $SU(2)$ of the weak interactions, and the $SU(3)$ of the strong interactions—are all subgroups of a larger group—in the simplest cases, $SU(5)$ or $SO(10)$. The enlarged gauge groups correspond to an enlarged set of vector bosons, whose masses define the scale of the GUT, above which the grand unified group becomes a good approximate symmetry. By "good," one means that the symmetry is linearly realized, so that the multiplicities, charges, and interactions of the particles are directly dictated by the representation theory of the GUT group.

By "linearly realized," we mean that the group transformations act as rotations, rather than shifts, on the internal spin-like degrees of freedom. Another way of expressing the condition of linear realization is that the symmetry does not change the vacuum, but only permutes the quantum state of particles or ripples on quantum fields in the vacuum.

GUT models have a lot of beauty, elegance, and simplicity, as well as extending the ideas of electroweak unification to solve a new set of problems. However GUTs also have problems that bring them into conflict with observation. For instance, GUTs typically have violations of conservation laws that are larger than observations permit. These are associated with the problems of doublet-triplet splitting and proton decay, for example.

These problems are directly associated with the virtual effects of the massive vector bosons corresponding to the additional generators of the GUT group. Of course, these effects are tiny when the massive vector bosons are very massive, in accordance with the principle that massive states decouple from low-energy processes. However, low energy experiments are sufficiently precise and constraining as to rule out the simplest GUTs, even when the GUT scale is as high as it can reasonably be made, some 10^{16} GeV, just an order of magnitude below the scale where quantum gravity becomes important.

Therefore it is advantageous to search for a theory that does away with the unwanted effects of the massive vector bosons of GUTs, while retaining the attractive features of GUTs, such as charge quantization.

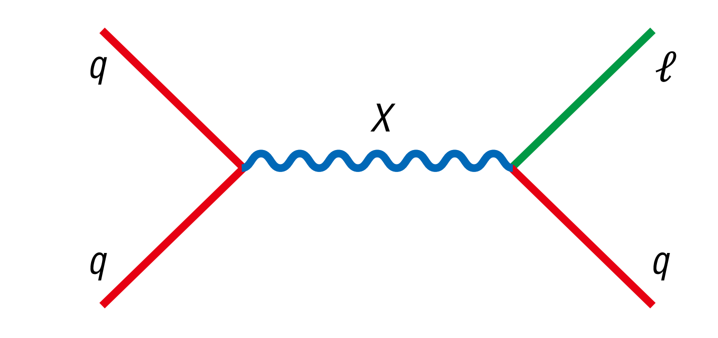
In a paper by T. Yanagida, J. Kehayias and myself, we demonstrated the viability of a radical yet simple alternative to grand unification. Our BSM model is based on the idea of the Nonlinear Sigma-Model (NLSM). The NLSM is an old concept in theoretical particle physics, based on the idea of the nonlinear realization of symmetry groups. That is, some symmetries of the system may be realized as (internal) shifts rather than as (internal) rotations. Equivalently, some of the symmetries may change not only the particles propagating through empty space, but empty space itself. This is the mechanism of spontaneous symmetry breaking, discovered by Nambu and Goldstone, which played a key role in describing the physics of pions and many other phenomena.

Our model is similar to a GUT in that the Standard Model gauge group $SU(3) \times SU(2) \times U(1)$ may be embedded in a larger simple group G. The difference is that the additional symmetries of G beyond those of the standard model are completely nonlinearly realized at all energy scales. This is in contrast to the situation in a GUT, where the hidden symmetries are linearly realized at some higher scale but spontaneously broken at low energies.

The NLSM scneario has the potential to solve many phenomenological problems that are difficult to resolve in the GUT framework. Most immediately, the small violations of conservation laws due to effects of virtual massive vector bosons are absent in the NLSM framework because... there are no massive vector bosons to generate those effects!

The enterprise of BSM model-building can benefit from the promising features of the NLSM only if the NLSM preserves the important phenomenological successes of GUTs. One key success of the GUT framework is the quantization of “weak hypercharge”—the $U(1)$ factor of the SM gauge group that determines the electric charges of elementary particles after electroweak symmetry breaking.

Remarkably, we have found that the $U(1)$ hypercharge assignments in the NLSM are indeed quantized by virtue of the embedding of hypercharge into a nonabelian simple group—despite that fact that the hidden symmetries of the group are never restored at any energy scale, and do not act on elementary particles at all!



The massive vector bosons, X, of the GUT group, typically mediate processes that turn quarks into leptons, leading to proton decay.

Furthermore, the possible values of the weak hypercharge for a given elementary particle are correlated with its representation under the other unbroken parts of the symmetry group. For instance, in the case of the $\mathbb{CP}^2$ NLSM, where $U(1)$ and $SU(2)$ are embedded in a nonlinearly realized electroweak $SU(3)$, the weak hypercharge of an $SU(2)$ doublet must be nonzero and equal to an odd number of a certain minimum unit. When the full SM gauge group is embedded into a larger nonabelian group such as $SU(5)$, the quantization rules for weak hypercharge are even more tightly specified, being dictated by a particle’s $SU(2)$ and $SU(3)$ representations.

Remarkably, it appears that the hypercharge assignments of the particles of the Standard Model *all* satisfy these baroque constraints. In fact, there is more than one way to satisfy them. There is a discrete choice of ways to assign hypercharge to the Standard Model particles in the NLSM embedding, with each embedding corresponding to a distinct and potentially phenomenologically viable model.

My co-authors and I are still exploring the many possibilities. However one bears special mention, and has resulted in a second paper by us. We have shown that when the electroweak $SU(2) \times U(1)$ is embedded in a nonlinearly realized $SU(3)$ of the $\mathbb{CP}^2$ model, one possible choice of hypercharge assignments—the minimal one—results in the identification of the Nambu-Goldstone bosons of the NLSM being identified with the Higgs boson. Prior to coupling the NLSM to gauge fields, the mass of the Higgs in this model is *exactly* zero, in accordance with Goldstone’s theorem. In other words, the Higgs boson is light not because of fine-tuning of its mass, but because of a symmetry principle that holds in a certain limit. Completely unexpectedly, we find that the NLSM provides a natural mechanism for solving the electroweak hierarchy problem!

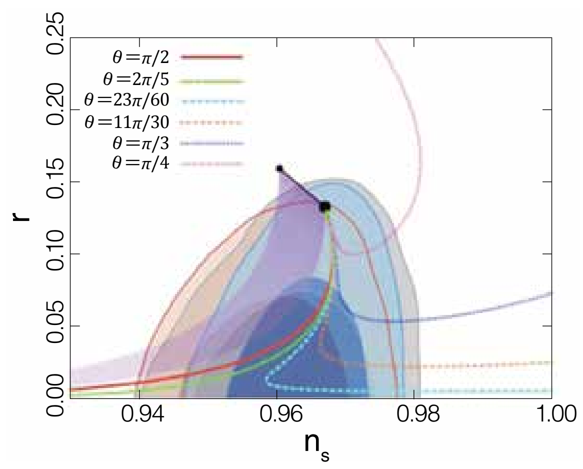
To conclude, we find that the NLSM idea provides a framework for BSM model-building that runs on a track parallel to the GUT paradigm, but solves many of its intractable problems while preserving its successes. This idea, a home-grown product of the Kavli IPMU research environment, will hopefully be a fertile ground for interesting ideas in the future.

5.6 Polynomial chaotic inflation in supergravity

Kazunori Nakayama

Recently the Planck satellite has provided the map of cosmic microwave background (CMB) anisotropy with unprecedented accuracy. The measurements of CMB anisotropy by the Planck satellite and the WMAP satellite clearly confirmed the idea of inflation in the early universe; inflation generally predicts nearly scale-invariant power spectrum of the curvature perturbation, which nicely agrees with observations. The next issue is to pin down the inflation model, or to identify the inflaton, the scalar field which drives the inflationary expansion.

One of the simplest inflation models is the so-called chaotic inflation (A. Linde, 1983). In the chaotic inflation model, the inflaton has just a power-law potential. Inflation occurs while the inflaton field rolls down the potential at the over Planckian field value. Interestingly, it predicts a large tensor perturbation power spectrum, or large tensor-to-scalar ratio, which can be seen as the B-mode polarization in the CMB anisotropy. Some CMB experiments dedicated for the B-mode polarization are ongoing and are expected to discover the B-mode signal if the chaotic inflation model is true.



Prediction of the polynomial chaotic inflation on the scalar spectral index (n_s) and the tensor-to-scalar ratio (r) for various values of angle parameter (θ). Allowed regions by cosmological observations including the Planck satellite at the 1 sigma and 2 sigma level are also shown (Ade *et al.*, arXiv:1303.5082). Figure taken from Nakayama *et al.*, arXiv:1303.7315.

While the chaotic inflation is a simple and interesting idea, there seem to have been some prejudice on the chaotic inflation that its prediction is so robust that non detection of B-mode would exclude the idea of chaotic inflation. Nakayama, Takahashi and Yanagida (2013) proposed the so-called polynomial chaotic inflation model, in which it was shown that adding extra power-law potential significantly modifies the original prediction of chaotic inflation with a single power law potential. It opens up a new possibility that relatively small, but observable tensor-to-scalar ratio can easily be generated. The authors also successfully put the model into the framework of supergravity, based on the early idea of Kawasaki, Yamaguchi and Yanagida (2000). The authors also proposed that the polynomial chaotic inflation can be caused by the right-handed sneutrino (the superpartner of the right-handed neutrino), extending the idea of Murayama, Suzuki, Yanagida, Yokoyama (1994). This is an interesting scenario, because the baryon asymmetry of the universe is automatically created by the decay of right-handed sneutrino.

Note: Very recently (Mar. 2014), the BICEP2 experiment reported the detection of the primordial B-mode with 7 sigma level (arXiv:1403.3985). It may indicate the chaotic inflation model with quadratic potential. Although more observations and analyses will be needed to accurately determine the tensor-to-scalar ratio, if any deviation from the quadratic potential prediction is found, the idea of polynomial chaotic inflation will be important.

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5.7 Flat potential of Higgs at the Planck scale

Masahiro Ibe

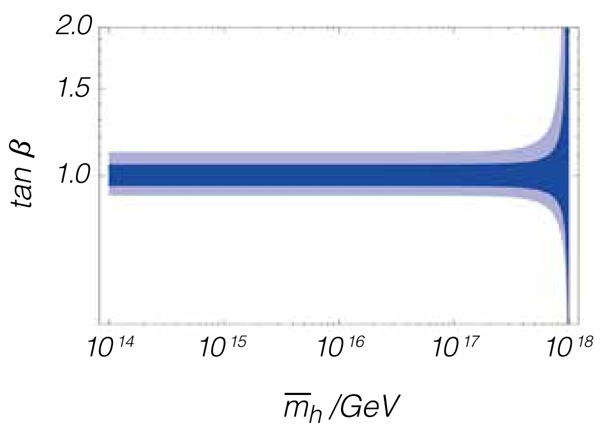

Fig. 1 The predicted value of the mixing angle between the two Higgs doublet β as a function of the fine-tuned light Higgs boson mass. Here, we assume that the supersymmetry breaking is at the Planck scale. In the figure we allow the soft masses of the two Higgs doublets to vary by 10% (blue band) and by 20 % (light blue band).

After the discovery of the Higgs boson at the LHC experiments, there is ongoing discussion as to what we can learn from the observed Higgs mass. In particular, we keep contemplating the origin of the electroweak scale. In addition to this longstanding problem in the Standard Model, however, the measured Higgs boson mass at around 126 GeV seems to pose a new puzzle; why the Higgs potential is so shallow. As is well known, the Higgs boson mass is related to the quartic coupling of the Higgs potential which determines the behavior of the Higgs potential at the large field value. From the measured Higgs boson mass, the quartic coupling is found to be around 0.1, and hence, the Higgs potential is found to be quite shallow. Furthermore, the extrapolated Higgs quartic coupling towards the higher energy scale seems to vanish at around the Planck scale within the uncertainties of the Standard Model parameters.

Motivated by this observation, we proposed a new possibility to explain the shallowness of the Higgs potential. In our scenario, the vanishingly small quartic coupling at the Planck scale is realized as an outcome of the electroweak fine-tuning in a class of models with Planck scale supersymmetry breaking [1]. When the supersymmetry breaking masses of the Higgs doublets are at the Planck scale, a fine-tuning condition that we are left with one light Higgs doublet leads to an almost 45 degree mixing between the two Higgs doublets when the two Higgs doublets have similar supersymmetry breaking masses (see Fig 1). Since the direction of the 45 degree mixing of the Higgs doublets corresponds to the so-called D-flat direction of the Higgs potential, the resultant Higgs potential is almost vanishing (see Fig 2). In this way, we can explain the shallowness of the Higgs potential in a model with Planck scale supersymmetry breaking. It is an intriguing feature of this mechanism that the shallowness of the Higgs potential is caused by the electroweak fine-tuning in the Higgs mass parameters. Future precise determinations of the Standard Model parameters at the ILC experiment will make it possible to test this scenario.

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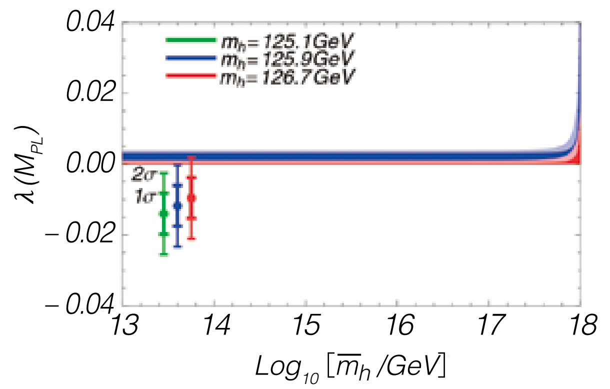


Fig. 2 The predicted Higgs quartic coupling at the Planck scale as a function of the fine-tuned light Higgs boson mass. The (light-)red shaded regions show the prediction allowing the soft masses of the two Higgs doublets by 10% (20%) assuming no stop-mixing effects. With sizable stop mixing effects the predicted Higgs quartic coupling gets slightly larger to the (light-)blue shaded regions, respectively.

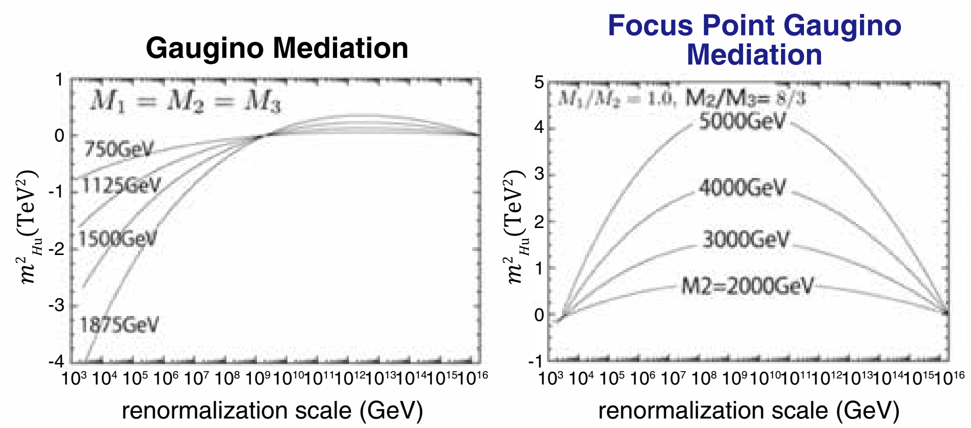
5.8 Focus point gaugino mediation

Norimi Yokozaki

To understand the origin of the weak boson mass scale is a remaining puzzle of the Standard model. The weak boson masses originate from the vacuum expectation value of the Higgs field once the electroweak symmetry is spontaneously broken. It is known that the observed weak boson masses are explained with the Higgs vacuum expectation value of 174 GeV. However, the Standard model does not tell us that why the electroweak symmetry is spontaneously broken and why the vacuum expectation value is not the Planck scale but as small as 174 GeV; the Higgs potential has a *negative* quadratic term of the order of (100 GeV)^2, although the radiative corrections generate a mass squared of the order of (10^{18} GeV)^2. The correct Higgs potential is obtained only with a huge fine-tuning; a bare parameter of the Higgs potential should be chosen very accurately such that (10^{18} GeV)^2 is subtracted to leave (100 GeV)^2.

In order to understand the origin of the weak boson mass scale, we proposed the "Focus Point Gaugino Mediation Model," based on the supersymmetric Standard model. In this model, only gaugino masses arise at the beginning, i.e., at the high-energy scale (the grand unified theory scale). The quadratic term of the Higgs potential as well as the other super-partner masses are generated from the gaugino loops at the low-energy. The radiatively generated quadratic term of the Higgs potential turns out to be negative, and hence, the spontaneous breakdown of the electroweak symmetry breaking is naturally explained. The scalar particles, which are the superpartners of the Standard Model fermions, have flavor universal masses. This feature is attractive since there is no flavor changing neutral current problem, which is a crucial obstacle for the low-scale supersymmetric models.

In the Focus Point Gaugino Mediation, the ratio of the Wino mass (M_2) to gluino mass (M_3) is fixed to the integer ratio 8/3 at the grand unified theory scale. As a result, the quadratic term of the Higgs potential becomes naturally of the order of (100 GeV)^2 (right panel of the figure); the Higgs vacuum expectation of 174 GeV is obtained without a large fine-tuning. Remarkably, the size of the quadratic term in the Higgs potential is insensitive to a superpartner mass. This behavior is rather nontrivial, and is in contrast to other supersymmetric models with a universal gaugino mass. In these models, the quadratic terms of the Higgs potential at the low energy are as large as a mass squared of a superpartner (2000–3000 GeV)^2 (left panel of the figure). Consequently, the vacuum expectation value of 174 GeV is obtained only with a large fine-tuning that a supersymmetric mass term is added to reproduce the (100 GeV)^2 quadratic term. In the Focus Point Gaugino Mediation model, thanks to the integer ratio of $M_2/M_3 = 8/3$, the origin of the weak boson mass scale is naturally understood. The superpartner of the Higgs boson, Higgsino, is predicted to be light, and is a candidate for a dark matter. This is a consequence of the small fine-tuning of the Higgs potential.



5.9 Latest results and status of the XMASS experiment

Yoichiro Suzuki

The aim of XMASS [1] is to detect dark matter directly in the largest liquid Xenon detector in the world placed underground in the Kamioka Observatory, in Japan.

There are many indications that dark matter exists through the observations of the gravitational effects in the Universe such as the measurement of the rotation velocity of galaxies and so on. Dark matter consists of about 27% of the energy and matter of the Universe, but its nature is not yet determined. Dark matter is thought to be a new kind of particles that can therefore be detected in terrestrial detectors though particle interaction. Once we detect dark matter, it may reveal the nature of dark mater particles.

XMASS detects dark matter by observing the energy deposited in the target material by the recoil nucleus that a dark matter particle kicked off. XMASS is a single-phase low temperature liquid xenon detector with a total target mass of about 850 kg and a fiducial mass of 150 kg. Interactions of dark matter in the target mass are very rare, and it is therefore necessary to make the background level of the detector very low. Our original aim was to reach the background level of about a few events per day in the fiducial mass. It is an extreme challenge to achieve this level.

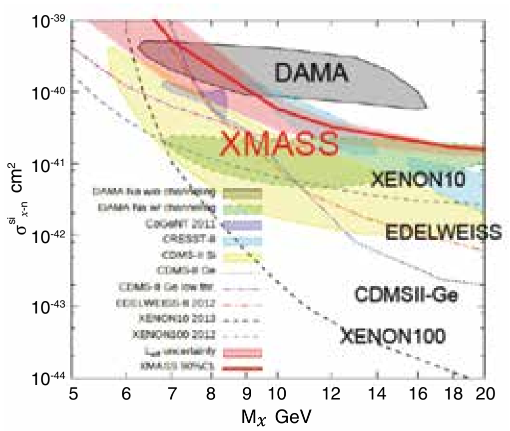


Fig. 1. Situation of low mass dark matter. Regions show positive claim and lines are upper limits.

Unfortunately, we have found unexpected backgrounds in the initial commissioning phase, that stemmed from the radioactive contaminants of aluminum used as a seal between the quartz-windows and metal-bodies of the low background light sensors. In order to reduce the effect from this obstacle, we have decided to cover those parts with an OFC ring since we were not able to remove the aluminum completely unless we replace all the light sensors to new ones. This refurbishment work was completed in November 2013 and we have started taking data again.

Although we could not remove the dirty aluminum but rather just put covers on, we have achieved about one order of magnitude of reduction of the background above 5 keV from the aluminum origin, and obtained more than two orders of magnitude reduction in the fiducial masses. We are now taking data stably and continuously.

In FY 2013, we have analyzed the data taken in the commissioning phase before the refurbishment.

Events in the entire mass of 850 kg inside of the photo sensor surface were used. For this whole volume analysis the energy threshold of 0.3 keV was achieved due to the high light yield of 14 photo-electrons per keV, which was the lowest among other dark matter experiments. Unfortunately the event vertex reconstruction does not work in such a low energy region. We therefore have to use the entire volume for the physics analysis. With only 6.8 days of data [2] and applying a simple cut that removes only characteristic Cherenkov events happening in the PMT quartz windows, our results have stepped into the interesting parameter region, as shown in Fig. 1, where the DAMA/LIBRA group claimed that they saw an annual time variation in their accumulated data for the last 13 years. This demonstrated the advantage of the large target mass and lower energy threshold of XMASS.

Another advantage of XMASS is the ability to detect e/γ events as well as nuclear recoils. Axion-like particles can be observed by looking for e/γ events in the detector. Possible dark matter axions may have masses between 10^{-6} and 10^{-3} eV and hardly be detected, and therefore they are called invisible axions. But axion-like particles, for example, may be produced in the sun and can be detected by XMASS through the axio-electric effect. The production rate, the energy spectrum, and the detection mechanism are known and calculated very well. We looked for such solar axions, but no evidence was seen, and the most stringent result on the axion-electron coupling, λ_{aee}, was obtained [3].

The γ-rays from de-excitation of the excited state of ^{129}Xe are signatures of the inelastic scattering of dark matter. For this case, 39.58 keV γ-rays or internal conversion electrons plus characteristic X-rays are observed, in addition to the small energy deposition from recoil nucleus. Since the energy of the signature is high enough for the vertex reconstruction to work very effectively in this energy region, we have used 41 kg of the inner most volume of the detector as a fiducial volume. The background level of 3×10^{-4} ev/keV/kg/day was obtained. With such a low background level, we could perform very sensitive measurement without subtracting backgrounds. The obtained upper limit for the inelastic cross section [4] was 3.2 pb for the 50 GeV WIMPs that is the best limit obtained so far through this kind of method.

WIMPs have masses of weak scale and an annihilation rate of order weak interactions to ordinary matter. We here looked for keV region dark matter with the interaction cross-section of super-weak, a few orders weaker than the usual weak interactions. One motivation was that the small crumps seen in galactic scale in a calculation to simulate development of the large-scale structure by a standard cold dark matter scenario would be avoided. The similar data set and methods of the inelastic scattering analysis mentioned above were used to look for the keV Bosonic super-WIMPs. We specifically look for vector and pseudo-scalar particles. No candidate excess was found and the limit we set was the best results [5] for this kind of searches as shown in Fig. 2.

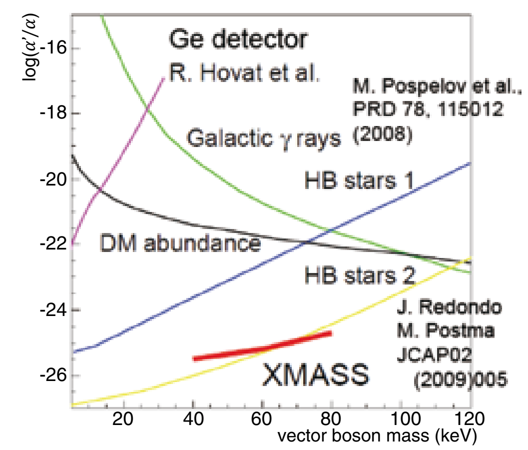


Fig. 2. Searches for bosonic super-WIMP dark matter.

We have demonstrated the advantage of the large target mass and very low energy threshold of XMASS by the physics results from the a in the commissioning phase. After the refurbishment work that ended in November 2013, we have been taking data continuously, and we will therefore accumulate stable data more than one year by the end of this year. Even with the same background level as in the commissioning phase, we are able to make an annual modulation measurement with higher sensitivity than the DAMA/LIBRA group. But for a higher WIMPs mass region, although the background was reduced by more than two orders of magnitude, our sensitivity was still limited by the same background source since the dirty aluminum was not removed, but rather just covered by the metal rings. Therefore a competitive sensitivity in the high mass region will be aimed in our next phase detector, XMASS1.5, where we will have a 1 ton fiducial mass, and we will exploit new ideas to reduce the surface backgrounds. We have already demonstrated that we are able to get into the region below $\sigma_{SI} < 10^{-46}$ cm^2, as shown in Fig. 3.

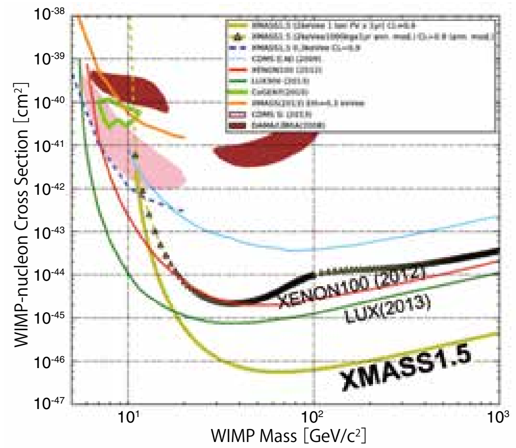
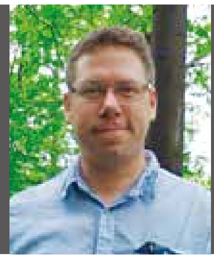


Fig. 3. XMASS1.5 sensitivity

[1] K. Abe et al., *XMASS detector,* Nucl. Instr. and Meth. A **716** (2013) 78
[2] K. Abe et al., *Light WIMP search in XMASS,* Phys. Lett. B **719** (2013) 78
[3] K. Abe et al., *Search for solar axions in XMASS, a large liquid-xenon detector,* Phys. Lett. B **724** (2013) 46
[4] H. Uchida et al., *Search for inelastic WIMP nucleus scattering on 129Xe in data from the XMASS-I experiment,* submitted to Prog. Ther. Exp. Phys.
[5] K. Abe et al., *Search for Bosonic super-WIMP Dark Matter with the XMASS Detector,* to be submitted

5.10 Status of the T2K experiment



Mark Hartz

Neutrino oscillations, are a phenomenon where one type or "flavor" of neutrino oscillates to another as the neutrino travels through matter or vacuum. The discovery of neutrino oscillations confirmed the existence of small but non-zero neutrino masses, evidence of physics beyond the Standard Model of particle physics. Now the Tokai-to-Kamioka (T2K) experiment has begun the search for Charge-Parity (CP) violation in the oscillations of neutrinos. In a CP violating process, the laws governing matter and antimatter are different. If CP violation by neutrinos is found, it may explain why the universe is made of matter only, and not equal parts of matter and antimatter, through the process of leptogenesis.

The T2K experiment generates of a beam of muon neutrinos (ν_μ) at the J-PARC accelerator in Tokai-mura by colliding high energy protons with a graphite target. A very small fraction of the neutrinos interact either at a detector located 280 m from the production point, called ND280, or at the Super-Kamiokande (SK) detector, located 295 km away. The interactions of ν_μ and electron neutrinos (ν_e) produce muons and electrons respectively, which are detected by the Cherenkov light they produce in the SK detector. Since the SK detector can differentiate between muons and electrons, the ν_e interactions can be identified. T2K looks for the appearance of ν_e at SK from $\nu_\mu \rightarrow \nu_e$ oscillations. The rate at which this transition happens depends primarily on two mixing angles, θ_{13} and θ_{23}. The rate also depends on the phase δ_{CP} that allows for CP violation.

The ND280 detector is used to measure the neutrino interaction rates close to their production point, where oscillation effects are negligible. These measurements are used to study the composition of the neutrino beam and the details of neutrino interactions in the detector. The ND280 measurements then provide a precise prediction of the neutrino interaction rates at SK for each neutrino oscillation hypothesis that is tested against the SK neutrino interaction data.

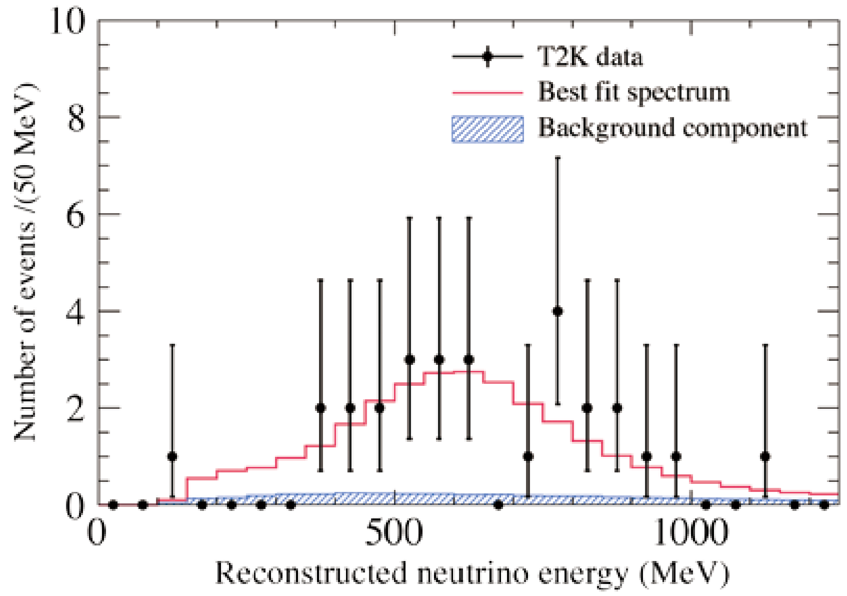


Fig. 1: The reconstructed energy of the observed ν_e candidate events, and the prediction with no $\nu_\mu \rightarrow \nu_e$ oscillations (blue) and with $\nu_\mu \rightarrow \nu_e$ oscillations (red).

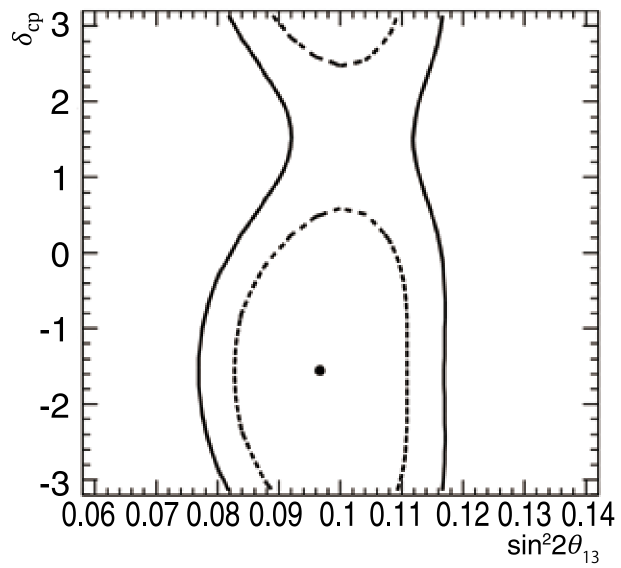


Fig. 2: The 68% (dashed) and 90% (solid) confidence regions for δ_{CP} and the θ_{13} mixing angle when T2K $\nu_\mu \rightarrow \nu_e$ oscillation and $\nu_\mu \rightarrow \nu_\mu$ survival measurements are combined with reactor anti-$\nu_e \rightarrow$anti-ν_e measurements. The dot represents the best fit point.

T2K detected the first indication of $\nu_\mu \rightarrow \nu_e$ oscillations in 2011 with the observation of 6 ν_e candidate events at the SK detector (Phys. Rev. Lett. **107** (2011) 041801). In July of 2013, T2K reported the observation of 28 ν_e candidate events with a data set 4 times larger than the 2011 results (Phys. Rev. Lett. **112** (2014) 061802). These events, shown in Fig. 1, have a statistical significance of 7.3σ, constituting a discovery of the $\nu_\mu \rightarrow \nu_e$ oscillation phenomenon.

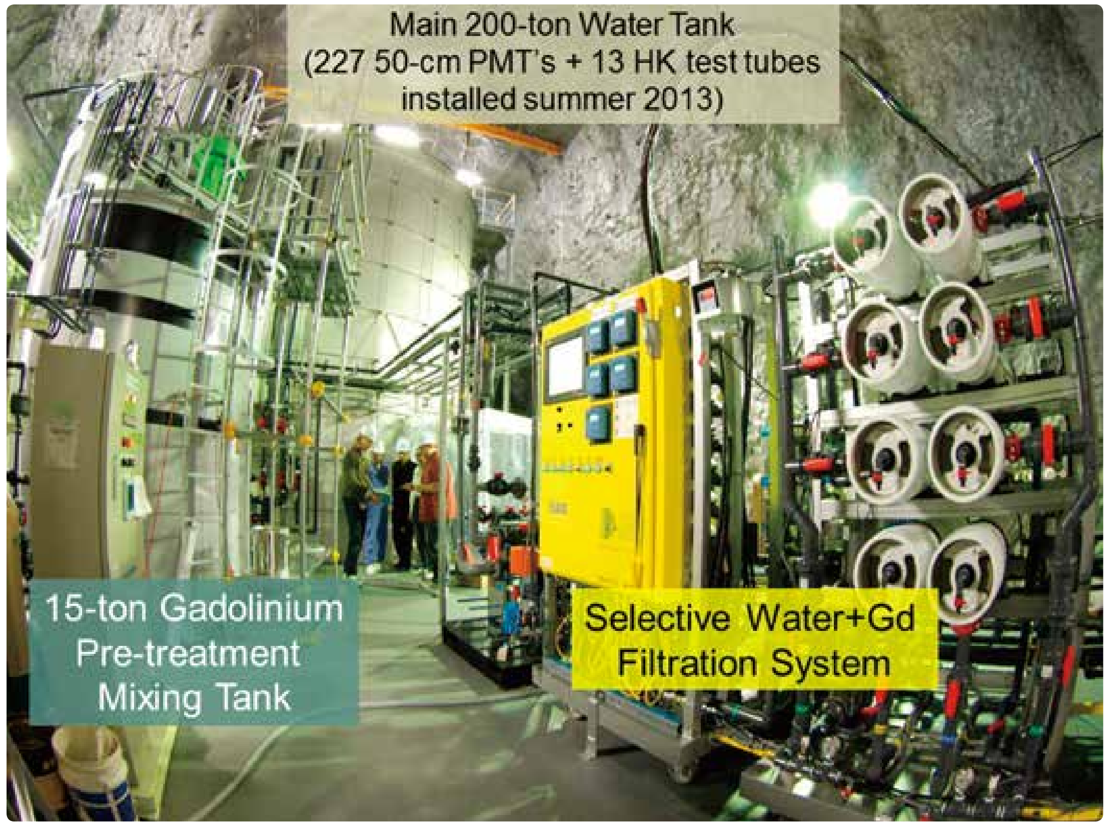
The $\nu_\mu \rightarrow \nu_e$ oscillation channel is the first observed mode of oscillations that can be used to probe the presence of CP violation in neutrino oscillations. If CP violation is present, the rate of $\nu_\mu \rightarrow \nu_e$ oscillations will be different for neutrinos and antineutrinos. By combining T2K measurements of $\nu_\mu \rightarrow \nu_e$ oscillations with reactor measurements of anti-$\nu_e \rightarrow$anti-ν_e oscillations and the T2K measurement of $\nu_\mu \rightarrow \nu_\mu$ survival, the first constraints on δ_{CP} have been made, as shown in Fig. 2. While the constraint is still weak, an indication of CP violation in the mixing of neutrinos has been observed.

The ultimate test of CP violation will come from the measurement of $\nu_\mu \rightarrow \nu_e$ oscillations for both neutrinos and antineutrinos. Now that T2K has discovered this transition for neutrinos, T2K has started operating with an antineutrino configuration for the beam. Since neutrinos and antineutrinos are produced and interact at different rates, a significant challenge for T2K will be the combined analysis of neutrino and antineutrino data with the proper accounting of all systematic effects.

With data from T2K and other neutrino oscillation experiments, the parameter δ_{CP} will be measured with ever improving precision over the coming years. The measurements of δ_{CP} and the other parameter governing the oscillations of neutrinos promise to shed light on our fundamental understanding of the Standard Model and the processes in the early university that gave rise to the imbalance of matter and antimatter.

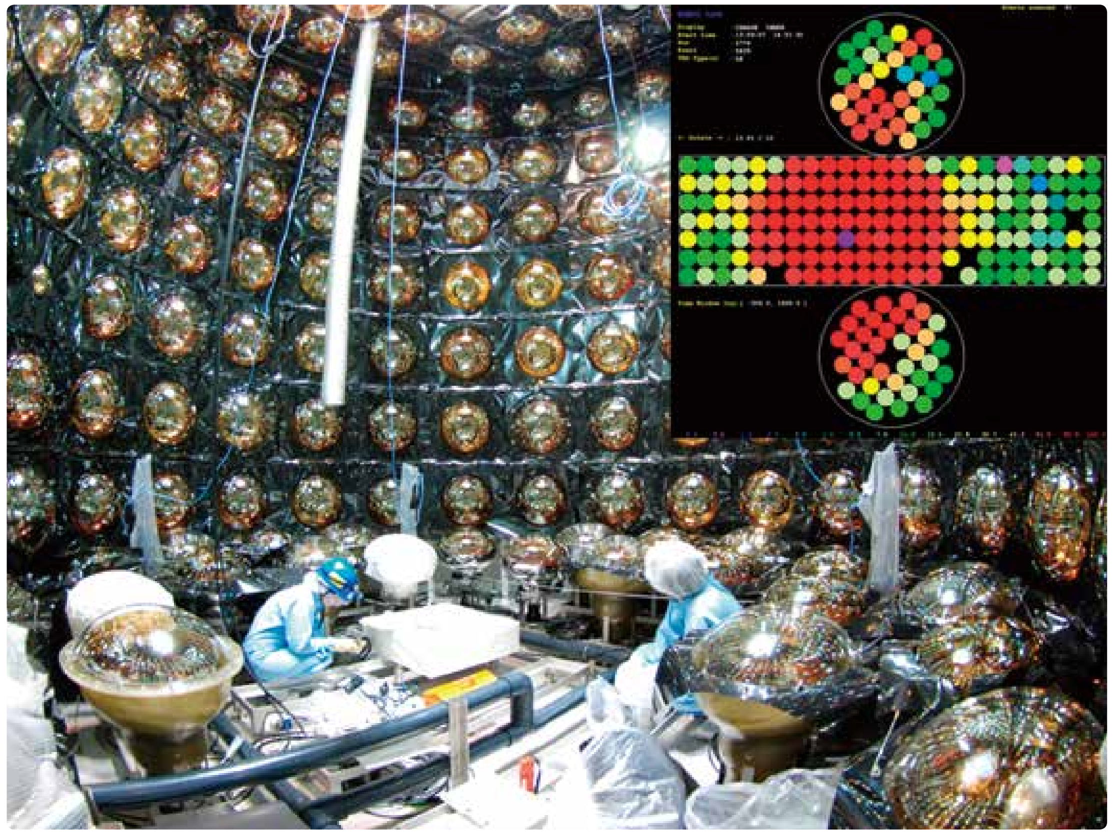
5.11 Current status of EGADS

Mark Vagins



Several years ago, Kavli IPMU Professor Mark Vagins and theorist John Beacom suggested adding 100 tons of gadolinium sulfate to Super-Kamiokande as a way—among other benefits—to detect the diffuse fux of supernova neutrinos produced by all the core collapse explosions since the onset of star formation. These ancient supernova neutrinos could provide a steady stream of information about not only stellar collapse and nucleosynthesis but also on the evolving size, speed, and nature of the cosmos itself. This ambitious plan is called GADZOOKS!, for Gadolinium Antineutrino Detector Zealously Outperforming Old Kamiokande, Super!

In order to demonstrate the safety and effectiveness of this approach, a dedicated gadolinium test facility has been constructed underground in the Kamioka mine near Super-K. Led by Vagins and Kavli IPMU PI Masayuki Nakahata, this large-scale R&D project is called EGADS: Evaluating Gadolinium's Action on Detector Systems. It includes a 200 ton scale model of Super-K complete with 240 photomultiplier tubes (227 50-cm Super-K style tubes plus an additional 13 prototype tubes being evaluated for use in the proposed Hyper-Kamiokande project), and a novel selective water filtration system. The picture above shows the view inside the experimental hall, while the one to the right shows a view inside the EGADS tank itself during construction. An event display of a downward-going cosmic ray muon is also shown.



Following 18 months of construction, EGADS first became operational in 2011, initially running with pure water. Various adjustments and tuning of the equipment followed, and by 2013, once it had been demonstrated that the filtered pure water in EGADS was equal in quality to that in Super-K, 400 kilograms of gadolinium sulfate—a world's record—was dissolved in the 200 ton main tank, allowing large-scale studies of gadolinium filtration and transparency to begin. The EGADS selective filtration system has achieved a gadolinium retention rate of 99.97% per pass, while simultaneously cleaning unwanted impurities from the water: unprecedented, and a major technical achievement.

Now, with full gadolinium loading we are within 15% of the transparency of ultrapure water. This is probably already sufficient, but work continues to improve upon this result. Further comparative studies both with and without dissolved gadolinium in the 200 ton tank will take place during 2014. If all continues to go well, we expect be ready to introduce gadolinium into Super-Kamiokande sometime within the next few years.

And what will happen to the extensive EGADS facility after that? As part of a 2012-2017 MEXT Research in Priority Areas grant for multimessenger astronomy received by Vagins, as soon as the R&D phase of the project is completed in 2014 EGADS will be converted into the world's most advanced supernova neutrino detector. While still called EGADS, the acronym's meaning will change to: Employing Gadolinium to Autonomously Detect Supernovas. During this new phase of its existence EGADS will utilize the unique properties of gadolinium to instantly identify supernova explosions in the Milky Way galaxy. Hooked into a Japanese network of optical, X-ray, gamma-ray, infrared, and gravitational wave observatories, EGADS will be able to alert the other members that a supernova is occurring *while the neutrinos from the blast are still passing through the Earth*. Such an alert can be issued hours before the arrival of the various electromagnetic signals, as they are generated considerably later in the explosive event than are the neutrinos. Therefore, following its role as a pioneering R&D laboratory, EGADS is now poised to become the first facility in the world to detect—and announce—the next supernova explosion in our galaxy.

5.12 Measurement of the dark matter distribution in fifty galaxy clusters

Masahiro Takada

We, an international team of astronomers[*1] from Taiwan, England, and Japan, have used the Subaru Telescope to measure the distribution of dark matter in fifty galaxy clusters and found that its density gradually decreases from the center of these cosmic giants to their diffuse outskirts. This new evidence about the mysterious dark matter that pervades our Universe conforms to the predictions of cold dark matter theory, known as "CDM."

Few scientists seriously doubt the existence of dark matter, which researchers discovered almost eighty years ago. Nevertheless, astronomers cannot directly see dark matter in the night sky, and particle physicists have not yet identified a dark matter particle in their experiments. "What is dark matter?" is a big unanswered question facing astronomers and particle physicists, especially because invisible dark matter probably makes up 85% of the mass of the Universe.

We used the Subaru Prime Focus Camera (Suprime-Cam) to investigate the nature of dark matter by measuring its density in fifty galaxy clusters, the most massive objects in the Universe. We wanted to use a large sample of galaxy clusters to find out how the density of dark matter changes from the center of a typical galaxy cluster to its outskirts.

The density of dark matter depends on the properties of the individual dark matter particles, just like the density of everyday materials depends on their components. CDM, the leading theory about dark matter to date, describes that dark matter particles only interact with each other and with other matter via the force of gravity; they do not emit or absorb electromagnetic radiation and are difficult if not impossible to see. Therefore, we chose to observe dark matter by using gravitational lensing, which detects its presence through its gravitational interactions with ordinary matter and radiation. According to Einstein's theory of relativity, light from a very distant bright source bends around a massive object, *e.g.*, a cluster of galaxies, between the source object and the observer. It follows from this principle that the dark matter in cosmic giants like galaxy clusters alters the apparent shape and position of distant galaxies. The Subaru Telescope allows us to measure very precisely how the dark matter in galaxy clusters distorts light from distant galaxies and gauge tiny changes in the appearance of a huge number of faint galaxies (Figure 1).

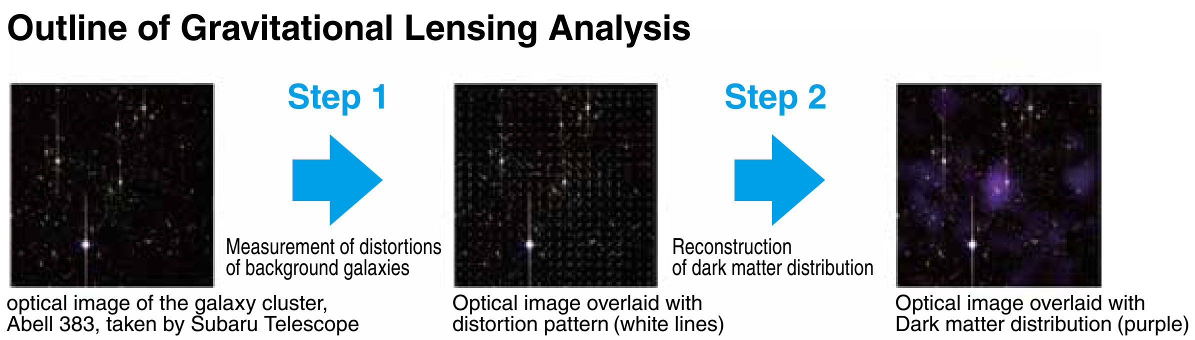


Figure 1: An outline of how the dark matter distribution (right) was reconstrcted from optical images (left) taken by the Subaru Telescope. A precise measurement of the shapes of background galaxies in observed images enabled the team to investigate the distortion pattern (center) and then reconstruct the distribution of dark matter in the galaxy clusters. (Credit: NAOJ/ASIAA/School of Physics and Astronomy, University of Birmingham/Kavli IPMU/Astronomical Institute, Tohoku University)

CDM theory describes how dark matter in galaxy clusters changes from its dense center to its lower density edges in two ways. One is a simple measure of the galaxy cluster's mass, the amount of matter that it contains. The other is a concentration parameter, which is a single measurement of the cluster's average density, how compact it is. CDM theory predicts that central regions of galaxy clusters have a low concentration parameter while individual galaxies have a high concentration parameter.

We combined measurements from observations of fifty of the most massive known galaxy clusters to calculate their concentration parameter. The average mass map (Figure 2) is remarkably symmetrical with a pronounced mass peak. The mass density distribution for individual clusters shows a wide range of densities. We found that the density of dark matter increases from the edges to the center of the cluster, and that the concentration parameter of galaxy clusters in the near Universe aligns with CDM theory. Past research based on a small number of clusters found that they had large concentration parameters and did not conform to CDM theory. In Contrast, measurement of the average concentration parameter from a large number of clusters yielded a different result, which supports CDM theory.

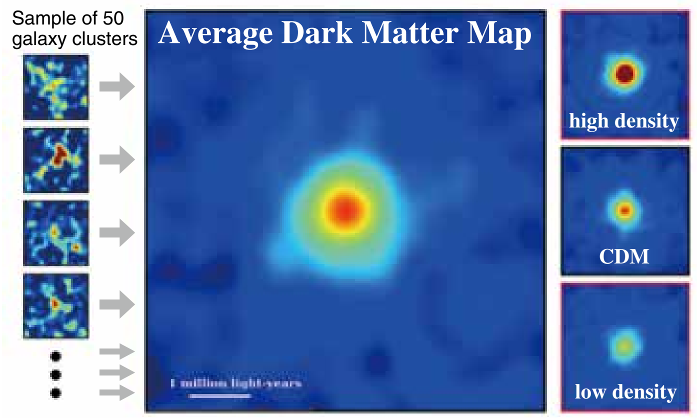


Figure 2: Dark matter maps for a sample of fifty individual galaxy clusters (left), an average galaxy cluster (center), and those based on dark matter theory (right). The density of dark matter increases in the order of blue, green, yellow, and red colors. The white horizontal line represents a scale of one million light-years. The map based on predictions from CDM theory (right, middle) is a close match to the average galaxy cluster observed with the Subaru Telescope. (Credit: NAOJ/ASIAA/School of Physics and Astronomy, University of Birmingham/Kavli IPMU/Astronomical Institute, Tohoku University)

Reference

Nobuhiro Okabe, Graham P. Smith, Keiichi Umetsu, Masahiro Takada, and Toshifumi Futamase, *LoCuSS: The Mass Density Profile of Massive Galaxy Clusters at z=0.2*, Astrophys. J. **769** (2013) 35

*1 The members of this research team are also team members of the "Local Cluster Substructure Survey (LoCuSS)," an international consortium of astronomers studying galaxy clusters, as part of the global research effort to answer big, open questions about the cosmos, including the nature of dark matter. More information about the LoCuSS consortium is available from Dr. Graham Smith, and at http://www.sr.bham.ac.uk/locuss.

5.13 The Subaru FMOS-COSMOS survey of star-forming galaxies at high redshift

John Silverman

Using the Fiber-Multi-Object Spectrograph (FMOS) mounted on the Subaru Telescope, a team of astronomers, led by John Silverman, is mapping the large-scale distribution of galaxies in the Cosmological Evolution Survey (COSMOS) at $z \sim 1.6$. First results demonstrate that galaxies, over nine billion years ago, provided a nurturing environment for the birth of new stars at remarkable rates while at the same time in an orderly manner. Even at these early times, there are signs of maturation, since the surroundings of massive galaxies were relatively dusty and enriched by heavier elements.

The COSMOS survey is designed to examine the role of the environment on the formation and evolution of galaxies with cosmic time. Determining whether the individual properties of galaxies, such as their rate of growth, are connected to the larger-scale environment catapults us into discovering what factors in the early Universe have shaped the current form of local galaxies. One part of that investigation is carrying out an intensive program of research using FMOS on the Subaru Telescope to acquire near-infrared spectra of over 1000 galaxies when the Universe was at the young age of 4 billion years old. This survey is ushering in the era of large spectroscopic efforts with the Subaru Telescope that will fully blossom with Prime-Focus-Spectrograph in the coming years.

One key to generating fruitful results is an international collaboration between COSMOS researchers to maximize optimal use of FMOS. In this project, researchers from Kavli IPMU and the Institute for Astronomy at the University of Hawaii formed an effective collaboration to implement our goal. The observations spanned 20 nights of observations starting in March 2012.

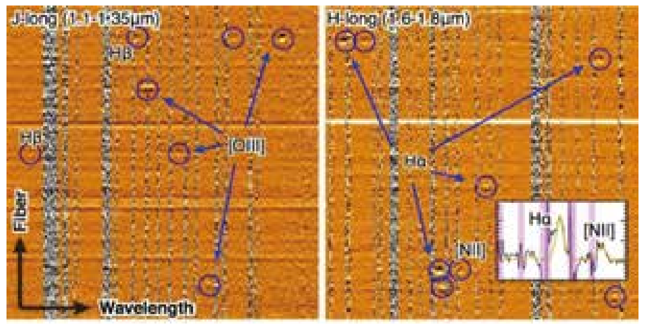


Figure 1: FMOS spectra in the J-band (left panel) and H-band (right panel), each of which filters light so that only specific wavelengths can pass through. The horizontal axis refers to the wavelength direction while the vertical axis indicates individual spectra observed through each fiber. Small blue circles indicate the detection of emission lines (left: Hβ and [OIII]; right: Hα, [NII]). The inset box shows the intensity of the emission lines for one galaxy. The vertical bands indicate the masked regions where bright sky (OH) emissions are prevented from entering science fibers placed on high-redshift galaxies. (Credit: FMOS-COSMOS)

Another important key to making our ambitious goal a reality is the advanced technology that FMOS offers to researchers. FMOS is a fiber-fed, near-infrared spectrograph that can acquire spectra from 400 galaxies simultaneously with a wide field of coverage of 30 arc minutes at prime-focus. Being able to capture so many objects in such a wide field of view is useful for a range of purposes: from studying galaxy evolution and variation with the galaxy environment to investigating star-forming regions, cluster formation, and cosmology. FMOS provides unprecedented views of the distant Universe by using fiber optic cables to collect the light of multiple objects over an area of the sky equal to that spanned by our Moon and also by using a built-in filter to remove unwanted bright emissions from the warm night sky.

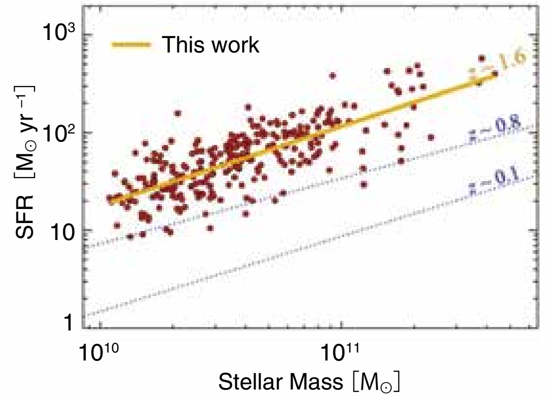


Figure 2: Rates at which new stars are forming in galaxies with a given total stellar mass. The galaxies observed with FMOS are shown in red. The y-axis shows the number of units of solar masses formed in a year. Star formation rates show a clear increase with mass, reaching over 500 solar masses per year. As the age of the Universe increases, star formation decreases uniformly across the population. (Credit: FMOS-COSMOS)

FMOS has now been operating in a high-spectral resolution mode, and its highly successful rate of detection is testimony to the realization of the instrument's full potential. Figure 1 displays the emission lines from a single FMOS pointing, which detected the following chemical species from the interstellar medium of high-redshift galaxies: hydrogen: Hα and Hβ, nitrogen: [NII], and oxygen: [OIII]. These so called "spectral signatures" provide a measure of the distance to the galaxy (i.e., its redshift). The ratio of the intensity of Hβ relative to Hα provides a measure of obscuring dust. The strength of the emission lines indicates the rate at which stars are forming while the ratio of [NII] relative to Hα is indicative of the level of chemical enrichment of the interstellar medium (i.e., metallicity). The FMOS-COSMOS survey is the largest near-infrared spectroscopic survey of galaxies at high spectral resolution and high redshift yet to be undertaken. Scientific results include the following:

1) Galaxy growth and a star-forming 'main sequence.' There is a highly ordered, general decline in the rate at which galaxies form stars over cosmic time. The FMOS observations shown in Figure 2 confirm that the rate of star formation varies with the total mass in stars. Although this relationship was first seen locally, this research shows that star formation not only persisted in early epochs but also that its rates of star formation were 20 times higher then! The star formation rate increases with a look-back time out to a corresponding redshift of $z \sim 1.6$. While this has been observed using other indicators (ultraviolet or infrared) at high redshift, FMOS's detection of the Hα emission line in the near infrared provides a consistent way to measure star formation in the early Universe and compare it with that of local galaxies.

2) Early dust formation and chemical enrichment. The galaxies observed with FMOS have significantly lower levels of chemical enrichment of gas (based on the ratio of nitrogen to hydrogen) in their interstellar medium than galaxies of the same mass in the local Universe near us (Figure 3). This finding agrees with a portrait of galaxies that have room to grow and are accreting pristine gas that fuels their intense star formation. Larger amounts of dust and metal content indicate that the more massive galaxies at $z \sim 1.6$ have evolved more fully and are similar to mature local galaxies that have stopped star formation.

3) Supermassive black hole growth. FMOS has enabled us to measure the masses of supermassive black holes by the detection of highly velocity-broadened emission lines, namely Hα and Hβ, that reach up to ~10,000 km s^{-1}. We have confirmed that such determinations of mass are reliable by comparing to other indicators (MgII). With close to 100 actively accreting supermassive black holes identified by their X-ray emission, we have shown that the rate of accretion onto massive black holes has an impact on the distribution of electron energies in the overlaying corona as seen in a hardening of the X-ray spectrum. This result solidifies previous studies that were based on heterogeneous samples and sheds light on the physics of accretion disks. Further investigations are underway to understand the motions of gas in the vicinity of a massive black hole and whether any additional kinematic signatures may indicate how black holes are fed (inflow) or shut off possibly due to an outflowing wind or radiation pressure.

The FMOS-COSMOS survey has completed its goal of having over 1000 galaxies with redshifts to map large-scale structure. While the current survey spans a sky area of one square degree in high-resolution mode, future efforts with FMOS may expand the areal coverage and complement instruments at other telescopes, which have wider spectral coverage or deeper penetrating power but are limited by a small area of coverage. Such complementarity may allow FMOS to detect the first structures (i.e., sites of higher than average density of galaxies) that likely evolved into the massive clusters that we see today.

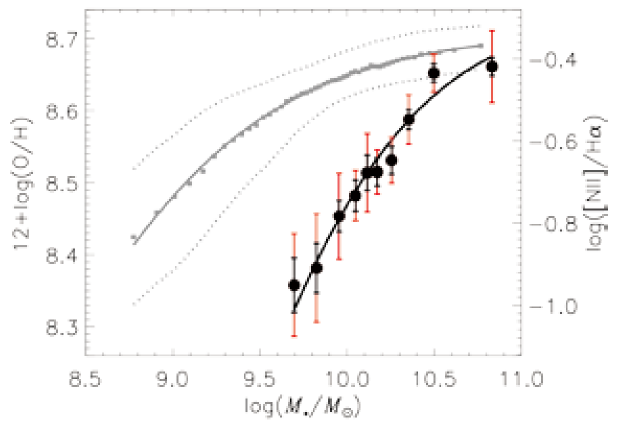


Figure 3: Relation between stellar mass and gas-phase metallicity as measured by the ratio of the strength of singly ionized nitrogen to hydrogen. The metallicity (i.e., level of chemical enrichment of the interstellar medium through stellar evolution) of the FMOS galaxies (large black circles) approaches that of local galaxies (grey curve) only at the highest masses. Less massive galaxies fall well below the metallicity levels seen with galaxies in SDSS at z ~ 0.

References:

D. Kashino, J.D. Silverman, G. Rodighiero, *et al., The FMOS-COSMOS Survey of Star-Forming Galaxies at z ~ 1.6 I. Hα-Based Star Formation Rates and Dust Extinction*, Astrophys. J. Lett. **777** (2013) L8

J. Zahid, D. Kashino, J.D. Silverman, *et al., The FMOS-COSMOS Survey of Star-Forming Galaxies at z ~ 1.6 II. The Mass-Metallicity Relation and the Dependence on Star Formation Rate and Dust Extinction*, arXiv:1310.4950

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J. Zahid, G. Dima, R. Kudritzki, L. Kewley, M. Geller, H. Hwang, J. Silverman, and D. Kashino, *The Universal Relation of Galactic Chemical Evolution: The Origin of the Mass-Metallicity Relation*, arXiv:1404.7526

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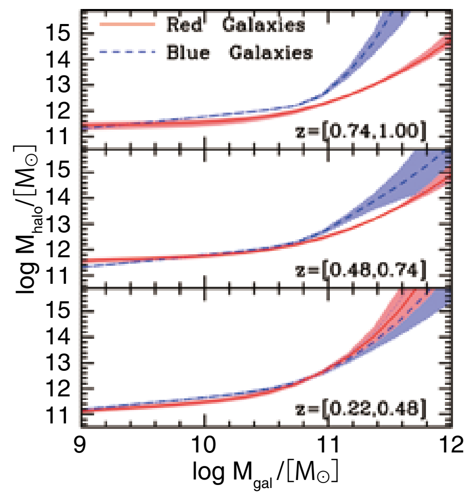
M. Brightman, J. Silverman, *et al., A Statistical Relation between the X-ray Spectral Index and Eddington Ratio of Active Galactic Nuclei in Deep Surveys*, MNRAS **433** (2013) 285

5.14 Evolution of the stellar-to-dark matter relation: separating star-forming and passive galaxies from z = 1 to 0

Alexie Leauthaud

In our current understanding of galaxy formation, galaxies are thought to reside in large over-densities of dark matter, named “dark matter halos.” The total mass and structure of dark matter halos are thought to play an important role in determining the fate of galaxies within. Exactly what role the dark matter environment plays though in determining galaxy formation, is not well known and is an active field of research. Previous research has shown that the dark matter mass of dark matter halos correlates strongly with galaxy mass, suggesting a tight connection between galaxy growth and halo growth. Galaxies however, are known to come in several varieties. For example, galaxies are often classified as being either “blue” or “red” based on the strength of their star formation. Galaxies also present various morphological classes, the two most common classes of which are galaxies with spiral arms, and those that are elliptical in shape with no presence of spiral arms. Does the dark matter also play a role in determining galaxy types? This is the question that we sought out to investigate.



One of the main difficulties in this type of investigation, is determining how to measure the properties of the dark matter halos that surround galaxies. How can we measure the properties of dark matter when dark matter is invisible? One way in which we can probe dark matter is to use a technique called gravitational lensing. Gravitational lensing is the bending of light caused by massive objects in the universe and leads to small distortions in the shapes of background galaxies. Measurements of the very small, percent level changes in the shapes of background galaxies are known as “weak lensing.” In order to carry out this investigation, we performed weak lensing measurements around sets of galaxies taken from a large Hubble Space Telescope Survey (known as the COSMOS field) and studied their dark matter properties as a function of galaxy mass and galaxy color. The high quality imaging from the Hubble Space Telescope enabled us to perform these measurements as various epochs in the universe, the first time that this has been possible.

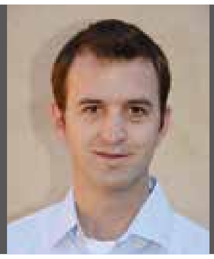
The results of this study conclusively showed the unexpected result that not only the dark matter environment of galaxies is strongly correlated with galaxy color, but that the form of this trend inverts over the history of the universe. The figure highlights this effect that was published in Tinker et al. 2013. This Figure shows that for small galaxies, red and blue galaxies live in similar dark matter environments. For massive galaxies however, when the Universe was young, blue galaxies lived in more massive halos. In the universe that we live in today however, red galaxies live in more massive halos. Why and how this surprising trend arises is yet unexplained. Work in actively underway to try and understand how this link between galaxy color and halo mass might be established.

This type of investigation will be measured with much larger signal-to-noise by the Hyper Suprime-Cam (HSC) survey that has just started on the Subaru Telescope. The HSC survey will image 1400 square degrees of the sky over the course of 5 years with the primary goal of performing weak lensing measurements. In the very close future, we will be able to investigate these trends using HSC with exquisite precision, yielding strong insights into the connection between dark matter and galaxy formation.

For more details, please see:
J. L. Tinker *et al.*, Astrophys. J. **778** (2013) 93

5.15

Detection of the gravitational lens magnifying a Type Ia supernova



Robert Quimby

A team of researchers led by Robert Quimby at the Kavli Institute for the Physics and Mathematics of the Universe has announced the discovery of a galaxy that magnified a background, Type Ia supernova through gravitational lensing. The discovery confirms the team's previous explanation for the unusual properties of this supernova. The team has further shown how such discoveries can be made far more common than previously thought possible. Type Ia supernova seen through gravitational lenses can be used to make a direct measurement of the universe's expansion rate (the Hubble parameter), so this discovery may have a significant impact on how cosmic expansion is studied in the future.

Quimby's team was formed at Kavil IPMU last year in response to a puzzling discovery: a supernova, named PS1-10afx, was found with the colors and photometric rise and fall of a normal Type Ia supernova, but its peak brightness was 30 times greater than expected. Type Ia supernova are known to be standardizable candles – objects with a known luminosity – and have famously been employed to reveal the accelerating expansion of our universe. PS1-10afx's anonymously bright appearance led some to conclude that it was not at Type Ia supernova at all but rather a completely new type of superluminous supernova. But to Quimby's team, the resemblance to normal Type Ia supernovae shone through.

The spectroscopic observations of PS1-10afx revealed the characteristic signature of a Type Ia supernova. Hydrogen, the most common element in the universe, was missing, and no helium was detected. There was, however, strong evidence for silicon and sulfur, which allowed Quimby to uniquely classify PS1-10afx as a Type Ia supernova. Given the redshift, which was set first by matching the broad spectral features to templates and second by narrow lines from the host galaxy, the broad band colors of PS1-10afx were consistent with those expected from a Type Ia supernova as well, and these colors evolved over time just as expected. To Quimby's team, this left just one explanation: PS1-10afx was a normal Type Ia supernova, but it was simply 30 times brighter than it should be. There was only one straightforward way to explain this.

The physics of Type Ia supernovae has been studied in detail over the past three decades, and there is no known way to produce a Type Ia supernova with normal colors and a normal light curve but a substantially higher luminosity. Generally, the rare supernovae that have been found to shine brighter than Type Ia usually have higher temperatures (bluer colors) and larger physical sizes (and thus slower light curves). New physics would thus be required to explain PS1-10afx as an intrinsically luminous supernova. However, Quimby's team found a second explanation that required only well demonstrated physics: gravitational lensing. If there was a massive body in front of PS1-10afx, it could warp space-time to form up to four magnified images of the supernova. If these were close enough together to appear as a single source in the survey, the total magnification would explain the anomalous brightness of PS1-10afx.

Although the available observations were consistent with the hypothesis of Quimby's team, there was one glaring omission that led some to question their solution: where was the lens galaxy? The existing data clearly showed the presence of the supernova's host galaxy, but there was no evidence for the needed foreground galaxy. Last September, Quimby's team set out to find the hidden lens. Using the Low-Resolution Imaging Spectrograph on the 10 meter Keck-I telescope, they spent 7 hours collecting light at the location of PS1-10afx, which had by then faded away itself (see figure 1). After carefully extracting the signal from the data, Quimby's team had their confirmation. Buried in the glare of the relatively bright host galaxy was a second, foreground galaxy (see figure 2). This second galaxy was faint enough to have previously gone unnoticed, but the analysis of Quimby's team showed that it was still the right size to explain the gravitational lensing of PS1-10afx.

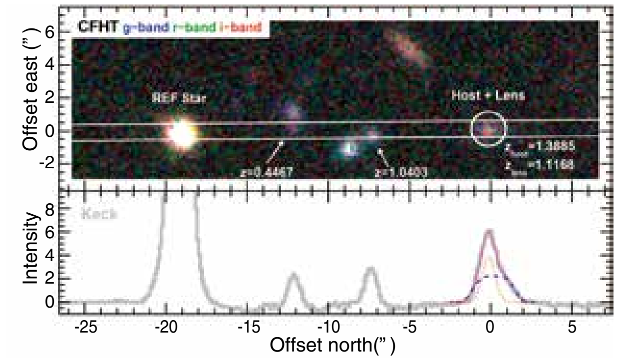


Figure 1: Keck/LRIS was used to study the light left at the location of PS1-10afx (circle) after the supernova faded away. The top panel shows the alignment of the spectrograph's slit on the sky, and the lower panel shows the total light received as a function of position along the slit.

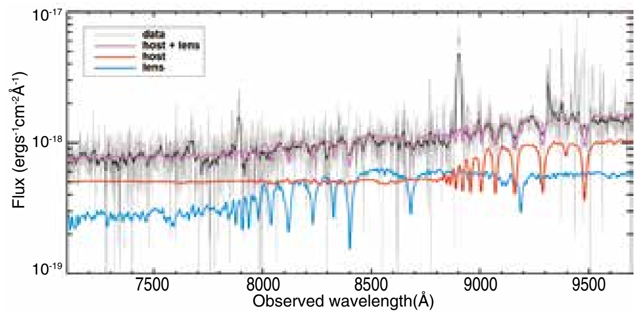


Figure 2: Decomposition of the observed spectra into lens and host galaxy components. We modeled the lens (blue line) and host (red line) as single stellar populations at z=1.1168 and z=1.3885, respectively. We varied the age and total stellar mass of each galaxy in order to find the sum (purple line) that best matched the observed spectra (gray; smoothed spectra in black). The models only include starlight; gas in the lens and host galaxies produces the narrow emission lines at about 7900 A and 8900 A, respectively.

The small size of this lens galaxy and the large magnification it produced were not exactly what the experts would have predicted for the first discovery of a gravitationally lensed Type Ia supernova, but they may very well be typical of discoveries to come. Because the likelihood of lensing increases quickly with redshift, and the Type Ia production rate also increase with redshift, it turns out to be more probable to find a highly magnified, high-redshift Type Ia supernova than a less magnified, lower-redshift one. A consequence of this is that most of the gravitationally lensed Type Ia supernovae that will be found with searches such as the coming Large Synoptic Survey Telescope can be identified by their colors, the higher redshift, gravitationally lensed supernovae being redder than the more nearby, un-lensed objects. This means that the survey need not resolve the individual image components, which enables more low-mass galaxies to serve as foreground lens and, over-all, increases the expected number of gravitationally lensed Type Ia supernovae by an order of magnitude.

In the future, when a target is identified as a possible lensed Type Ia supernova, high-resolution follow-up observations can be taken to resolve the individual image components. If the angles and time-delays between each component can be measured, a direct test of cosmic expansion is possible. Each image comes from the same source but travels a different path length on its way to the observer, so the universe has more time to expand over the longer path. This adds an additional phase delay. By timing the delays precisely and comparing these to the delay expected from the geometry of the lens, the Hubble parameter can be inferred without a distance ladder. The discovery and selection method crafted by Quimby's team may thus soon improve our understanding of our expanding universe.

6 Awards

Tomoyuki Abe

On April 8, 2013, the Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT) announced that the 2013 Young Scientists' Prize went to Kavli IPMU Assistant Professor Tomoyuki Abe for his "Fundamental work on theory of arithmetic D-module and research on the Langlands correspondence." This award is given to young scientists under 40 years old in recognition of their outstanding original, or, challenging exploratory, research accomplishments, which show their ability for high-level research. In 2013, 89 young scientists, including Abe, won the award.

Yoichiro Suzuki

The European Physical Society announced to award the Giuseppe and Vanna Cocconi Prize to Yoichiro Suzuki, Director of Kamioka Observatory at the Institute for Cosmic Ray Research, the University of Tokyo and Deputy Director of the Kavli IPMU, and Professor Art McDonald "for their outstanding contributions to the solution of the solar neutrino puzzle by measuring the flux of all neutrino flavors from the Sun with the SNO and Super-Kamiokande experiments." The Giuseppe and Vanna Cocconi Prize has been awarded every two years since 2011 by the High Energy and Particle Physics Division of European Physical Society. The Prize is awarded to an individual or individuals who have made outstanding contributions to Particle Astrophysics and Cosmology in the past fifteen years.

Hitoshi Murayama

On April 24th, 2013, the American Academy of Arts and Sciences announced 198 newly elected members including Hitoshi Murayama, Director of the Kavli IPMU. It was founded in 1780 to cultivate every art and science, and from the latter half of the 20th century, it has been an independent policy research center that conducts multidisciplinary studies of complex and emerging problems. Past members include George Washington, the first President of the United States, Albert Einstein, Nobel Laureate in Physics, as well as leaders in a broad range of areas including politics, business, science, and art at all times. The newly elected members include David Weinland, 2012 Nobel Laureate in Physics, Robert De Niro, a renowned actor, and many other distinguished scientists, artists, and politicians. The Academy has selected as members the finest minds and most influential leaders from each generation, and selection by the Academy has always been one of the highest honors in the United States. Director Murayama said, "I never imagined that I would be among such a distinguished list of scientists. This will be a great opportunity for me to advance science in this area of research, as well as to promote the contribution of those with Japanese ancestry."

Toshitake Kohno

Toshitake Kohno, Professor at the Graduate School of Mathematical Sciences, the University of Tokyo and Principal Investigator at the Kavli IPMU won the Mathematical Society of Japan's 2013 Geometry Prize for "A Series of Works in Geometric Representation Theory for Quantum Groups."Geometry Prize was established in 1987 by Mathematical Society of Japan (MSJ) and given to researchers who have contributed to the development of geometry in a broad sense, including differential geometry, topology, and algebraic geometry, by obtaining outstanding results, or by accumulated important achievements for many years of research, or by giving excellent guide to young mathematicians by writing books and/or by other means. It is noteworthy that Kavli IPMU mathematicians had won the MSJ Geometry Prize also in 2011 (Professor Kyoji Saito) and in 2012 (Associate Professor Yukinobu Toda).

Takaaki Kajita

Takaaki Kajita, Director of the Institute for Cosmic Ray Research, the University of Tokyo, and Principal Investigator at the Kavli IPMU received the 2013 Jujius Wess Award. The Julius Wess award was created in 2008 to commemorate the outstanding work of Professor Julius Wess in theoretical physics, and it is granted to elementary particle or astroparticle physicists for outstanding achievements by the Karlsruhe Institute of Technology (KIT). Professor Kajita received this award for his "significant role in the discovery of atmospheric neutrino oscillations with the Super-Kamiokande Experiment."

Tadashi Takayanagi

Tadashi Takayanagi, Professor at the Yukawa Institute for Theoretical Physics, Kyoto University, and Kavli IPMU Visiting Senior Scientist, and Shinsei Ryu, Assistant Professor at University of Illinois, Urbana-Champaign, were awarded the 28th Nishinomiya-Yukawa Memorial Prize for "Study on Quantum Entanglement with Application of the Holographic Principle." The Nishinomiya-Yukawa Memorial Prize is presented to promising young physicists under 40 years of age by the City of Nishinomiya to encourage research in theoretical physics. Tadashi Takayanagi was at IPMU from September 1, 2008 to March 31, 2012 as an Associate Professor.

Fuminobu Takahashi

The 2013 Young Scientist Award in Theoretical Particle Physics was awarded to Fuminobu Takahashi, Associate Professor at Tohoku University and Kavli IPMU Visiting Scientist, and Tetsutaro Higaki, postdoctoral fellow at the KEK Theory Center. Their article "Dark Radiation and Dark Matter in Large Volume Compactifications," published in the Journal of High Energy Physics **1211** (2012) 125, was recognized by the Japanese particle theorists community which selects recipients of this award from its young members to encourage them. Fuminobu Takahashi was at IPMU from December 1, 2007 to January 31, 2011 as an Assistant Professor.

Yukinobu Toda

Kavli IPMU Associate Professor Yukinobu Toda has won the 2014 MSJ (The Mathematical Society of Japan) Spring Prize for his outstanding contributions to the study of derived categories of algebraic varieties. The MSJ Spring Prize was established in 1988 as the successor of the Iyanaga Prize which had been established in 1973. It is awarded to its members under the age of 40 to recognize outstanding mathematical achievement. The award ceremony was held on March 16, 2014 at the MSJ Spring Meeting 2014 at Gakushuin University.

Mark Hartz

The J-PARC Neutrino Beam Group (Professor Takashi Kobayashi of KEK as a representative) has been awarded the 2013 Suwa Prize by the FAS (Foundation for High Energy Accelerator Science) for their contribution to the discovery of electron neutrino appearance in the T2K Experiment by creating and operating the highest intensity neutrino beam facility. Kavli IPMU Assistant Professor Mark Hartz is among the prize winners. The Suwa Prize was established by the FAS and is given to researchers, engineers, and research groups recognizing exceptional performance, such as long-term contributions, for the development of high-energy accelerators and their application in science.

7 Conferences

7.1 Mini-Workshop on "Massive Gravity and Its Cosmological Implications"

Organizers

Emir Gumrukcuoglu (Kavli IPMU)
Chunshan Lin (Kavli IPMU)
Kei-ichi Maeda (Waseda University)
Shinji Mukohyama (Kavli IPMU)

The Kavli-IPMU mini-workshop on "Massive Gravity and Its Cosmological Implications" was held from April 8th to April 10th, and brought together researchers interested in the theoretical and observational aspects of modified gravity, specifically the massive gravity theory. A total of 36 participants attended the workshop, reporting on 12 active contributions in the form of oral presentation.

Gravitation remains the most mysterious among the four known fundamental forces in nature. Although General Theory of Relativity has been in perfect agreement with experiments and observations, we do not really know how gravity behaves at distances shorter than hundredth of a millimeter or at distances of the order of the size of the observable universe. Thus, it is natural to ask whether gravity can be modified at these distances in a theoretically controllable and experimentally viable way. The large distance modifications are especially attractive, since it is expected that they may provide an alternative explanation for the current accelerated expansion of the universe. Massive gravity and its extensions have recently become one of the popular candidates in this direction.

The goal of the workshop was to bring together the leading researchers in this field, allowing them to share their contributions in the conference-form talks, and exchange ideas in the lengthy discussion sessions. The first day of the workshop focused on the theoretical aspects of massive gravity. Cedric Deffayet emphasized the subtle problems associated with the usual construction of the theory and introduced alternative formalisms which may overcome some of these. Fawad Hassan explored the connection between the bi-metric theories (which are two metric extensions of massive gravity) with some known modified gravity models. These connections can then be exploited to obtain healthy reductions, such as a partially massless theory, which can avoid some of the observational bounds. The talk by Keisuke Izumi addressed the recent concerns on the causality in the theory in comforting way, pointing out inconsistencies in the arguments. The day was concluded by Robert Caldwell's positive talk on new observational signatures of non-linear effects arising from massive gravity.

The second day was mostly dedicated to the solutions. Mikhail Volkov, Emir Gumrukcuoglu and Chunshan Lin presented their work on cosmological and black hole solutions in various versions of the theory. In the framework of the simplest version of the theory, difficulties in getting stable universe solutions were pointed out, while several approaches in curing them were proposed and discussed. In the context of extended theories, Tsutomu Kobayashi and Rampei Kimura discussed the mechanism for screening of the modifications at observable scales. The session was concluded by Tetsuya Shiromizu, who shared his concern on the ground state of spacetimes with/without black holes.

The third day was devoted to two talks by Kei-ichi Maeda and Jiro Soda, on anisotropic solutions in the bi-metric theory. Although any anisotropies get diluted, the rate of the decrease was found to be slower than in standard general relativity, opening up possibilities for observational signatures. The afternoon session was devoted to discussions; after the summary talk by Shinji Mukohyama, Kei-ichi Maeda moderated a discussion session in which the current theoretical development and challenges that lie ahead was actively discussed.

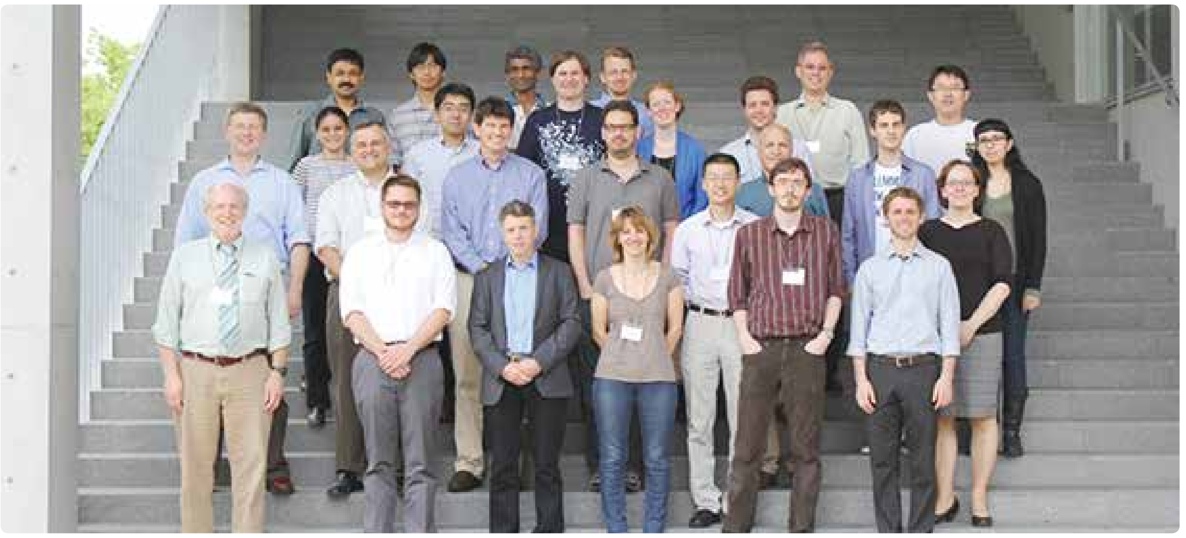
The discussions in the sessions, as well as in the generous breaks proved to be essential to guide the research directions of the participants and initiate collaborations.

(Written by Emir Gumrukcuoglu)

7.2 MaNGA Focus Week

Organizer

Kevin Bundy (Kavli IPMU)



The Kavli IPMU "MaNGA Focus Week" concluded with great success on Friday, May 24th. MaNGA stands for "Mapping Nearby Galaxies at Apache Point Observatory," a new Sloan Digital Sky Survey that will begin in 2014 and run for six years with the aim to obtain resolved spectroscopy for an unprecedented sample of 10,000 nearby galaxies. (See, Kavli IPMU News No. 20, pp. 16–17.) Kavli IPMU's own Kevin Bundy is the Principal Investigator. The focus week served not only as an all-hands team meeting designed to advance preparations for the project but also as the Critical Design Review of the MaNGA instrumentation upgrades that are being planned for the Sloan 2.5 m telescope.

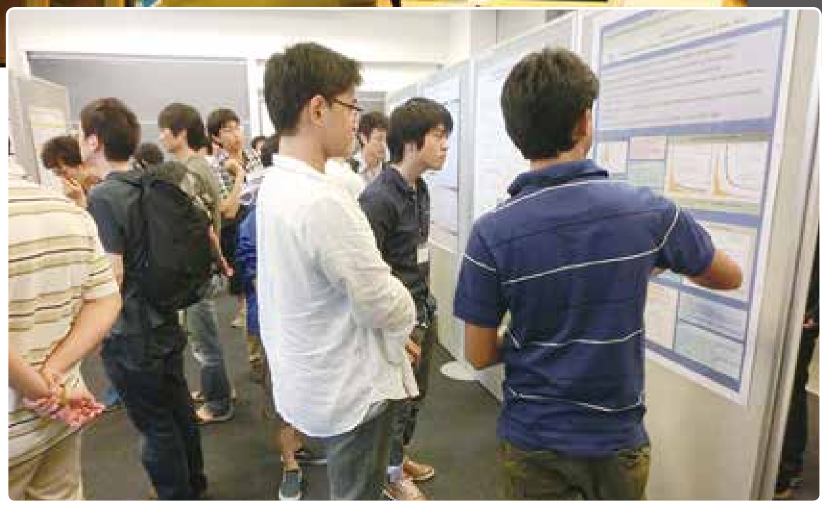
An external committee of prominent experts reviewed over 200 pages of original material developed by the MaNGA team and evaluated presentations on aspects of the project that ranged from the hardware design to the observing strategy and software tools. The primary focus was a new type of "integral field unit" (IFU) design innovated by the MaNGA team, which combines up to 127 optical fibers into a tightly packed and highly regular hexagonal array. The team demonstrated through results both in the lab and with prototypes taken on sky that their design could regularly achieve the theoretical maximum throughput of 96% in a cost-effective solution that integrates seamlessly into the existing infrastructure at Apache Point Observatory.

The review committee was highly impressed with the team's preparation and mature design, the result of an impressive and rapid effort over the last 14 months. They recommended the project proceed on track to full production and deployment in August 2014. At the same time, they helpfully identified a potential weak point in the quality of skyline subtraction that MaNGA hopes to achieve, an issue that the team is now aggressively addressing. With this positive feedback from the review, MaNGA can look forward to the first of its IFUs being constructed over the summer of 2013, and the first of ultimately six "cartridges" of MaNGA hardware ready for testing at the observatory in February 2014.

Also discussed were MaNGA's next steps which include refinements to the sample selection and observing strategy as well as the development of software analysis tools which are crucial for providing data products that will eventually be released to the public. For each of the 10,000 galaxies in the sample, MaNGA will provide maps of the internal properties of stars and gas as well as the velocity fields of both constituents. This information will provide valuable new constraints on the life cycle of galaxies, including the physical processes that regulate their birth, continued growth at late times, and their "death" through the cessation of star formation. The ability to use velocity maps to "weigh" galaxy components will also constrain the amount of dark matter in galaxies and possibly provide tests of the dark matter profile shape and alternate gravity theories.

(Written by Kevin Bundy)

7.3 The Kavli IPMU School on the Future of Collider Physics



Organizers

Hitoshi Murayama (Kavli IPMU/Berkeley)
Shigeki Matsumoto (Kavli IPMU)
Mihoko Nojiri (KEK/Kavli IPMU)
Biplob Bhattacherjee (Kavli IPMU)
Satyanarayan Mukhopadhyay (Kavli IPMU)
Sho Iwamoto (Kavli IPMU)

The Kavli IPMU School on the Future of Collider Physics was successfully conducted during July 16–19, 2013. Having a school dedicated to the future prospects of collider physics was a very timely idea for three main reasons: the recent discovery of a Higgs-like boson at the CERN Large Hadron Collider (LHC) and the subsequent measurement of some of its properties in the early LHC run, the promise of gathering a wealth of new information on the Higgs in the next runs of the upgraded LHC, and finally, the prospects of having an International Linear Collider (ILC) in the near future as a Higgs factory and a precision machine. All of the three broad areas were covered at great depth in the school, which included 12 lectures by leading experts in the field, one poster presentation session by the participants and a panel discussion session on the big questions and promising directions in this subject.

It was no surprise that most of the lecturers focused on different aspects of Higgs physics, with topics ranging from an effective field theory framework to parametrize the deviations of Higgs properties from the Standard Model and the current status of its measurements, to important concepts in statistics necessary to properly interpret the data presented by the ATLAS and CMS collaborations. The current status of theoretical calculation of Higgs cross-sections, the next-to-leading order event generators and future goals in improving the higher order QCD calculations and parton distribution functions were also reviewed. New techniques in top quark physics were discussed as well, which might prove to be crucial in new physics search at the LHC.

The school was kick-started by an opening lecture by Kavli IPMU Director Hitoshi Murayama, where he gave a broad overview of the physics behind a high-precision machine like the proposed ILC with its associated challenges, and the accuracy with which it can determine the properties of new particles at the weak scale including the Higgs boson. Hitoshi also informed us about the current status of Japan hosting the ILC in the near future. This was followed up in the subsequent days with very thorough talks by experimentalists on the high-luminosity LHC programme and details on the ILC accelerator and detector developments and physics goals.

The participants included around 45 graduate students and postdocs from all over Asia, most of them being from Japan, India, South Korea, Taiwan, and China. They also presented their recent work in a poster session, during which very intense and lively discussions took place.

(Written by Satyanarayan Mukhopadhyay)

7.4 The Kavli IPMU Focus Week Workshop on Cosmology with Small Scale Structure

Organizers

Alexie Leauthaud (Kavli IPMU)
Surhud More (Kavli IPMU)
Masahiro Takada (Kavli IPMU)

The Kavli IPMU Focus Week Workshop on "Cosmology with Small Scale Structure" was held from July 22 to July 26 and brought together participants from all over the world interested in probing cosmological parameters of the Universe and modifications to gravity from small scale astrophysical observations of weak lensing, galaxy clustering, redshift space distortions, and galaxy clusters.

The main challenge in realizing the true potential of these probes is our limited understanding of galaxy formation. The focus of the workshop was to discuss ways to best marginalize over these uncertainties and tease out the cosmologically interesting information from these observables.

The workshop was held as a moderated round table discussion on the current developments in the field and challenges that lie ahead. The discussion on the first day revolved around designing sensitivity tests to identify a combination of observables that could be used to learn about galaxy formation phenomenologically, and simultaneously learn about the cosmological parameters. Numerical simulations of cold dark matter are the workhorse for cosmological studies from small-scale structure. The second day focused on the accuracy and large volume requirements on numerical simulations. The third day was devoted to the topic of redshift space distortions, which reflect our inability to measure the exact positions of galaxies due to their motions. There was a discussion on the progress in modelling these distortions. The fourth day examined how baryonic processes can cause a back-reaction on the dark matter and understanding parameters that can capture these processes. This is essential to exploit the statistical power of measurements of cosmic shear which several ongoing and large upcoming surveys will provide. There was also a discussion on modifications to gravity, novel probes on large scales, and the ensemble of simulations of specific modifications to gravity currently available. The last day was devoted to identification of galaxy clusters in large imaging surveys, and their use as probes of cosmological parameters.

The last day also featured two summaries of the workshop, an optimist's summary delivered by Frank van den Bosch and a skeptic's summary delivered by Martin White. The optimist's summary presented some of the difficulties in modeling of small scale structure that were discussed during the workshop, but also showed that these small scale probes are significantly constraining even after marginalization over a large number of galaxy formation and modeling uncertainties. It also highlighted the current tension between cosmological parameters obtained from the cosmic microwave background experiment Planck, and a number of small-scale structure probes on the matter density and the amplitude of density fluctuations in the Universe. The skeptic's summary included a parallel to collider experiments in particle physics. The suggestion was that precision measurements of cosmological parameter should perhaps be left to clean probes such as baryon acoustic oscillation experiments or CMB experiments (analogous to electron machines in particle physics), while small scale structure probes (analogous to proton machines) are excellent tools for discovery than precision. It highlighted the importance of demonstrating the resilience of small scale probes to uncertainties in galaxy formation physics. It also suggested the need to perform sensitivity studies (some ideas discussed during the workshop), to help design observational campaigns in the future.

The topics discussed during the workshop are central to guide the research directions necessary to exploit the potentials of the upcoming Hyper Suprime-Cam survey and the Prime Focus Spectrograph survey.

(Written by Surhud More)

Conferences

7.5 European Union's UNIFY Workshop

Organizer

Hirosi Ooguri (Kavli IPMU / Caltech)

Since 2011, the Kavli IPMU has been participating in the research program entitled, "Unification of Fundamental Forces and Applications (UNIFY)," under the International Research Staff Exchange Scheme of the Marie Curie Actions of the European Union (EU). There are three nodes in the UNIFY network in Europe: the Berlin node consisting of Humboldt University and the Max-Planck Institute for Gravitation Physics, the Paris node with the École Normale Supérieure, the University of Paris VI, and the Centre de Saclay of the French Atomic Energy Commission, and the Portuguese node with the University of Porto. Non-EU nodes in the network are at the California Institute of Technology and the Stony Brook University in the United States and the Perimeter Institute of Canada, as well as the Kavli IPMU. The purpose of the program is to enhance exchanges and collaborations among researchers in the UNIFY network. The Marie Curie Programs cover the travel expenses of EU researchers when they visit non-EU nodes. The research objectives of the programs are fundamental aspects of superstring theory and quantum field theory toward understanding the unification of forces in nature. Hirosi Ooguri represents the Kavli IPMU as a member of the executive board of the UNIFY network.

Over the past 3 years, several collaborations have emerged within the UNIFY network. Every summer, the network hosts its main conference. The first main conference was held at the University of Porto in 2011, followed by the second main conference in Berlin in 2012. This summer, the third meeting was held at the Kavli IPMU. For two weeks from August 26 to September 6, the Kavli IPMU hosted the UNIFY workshop entitled, the "Kavli IPMU Workshop on Gauge and String Theory."

Unlike regular research conferences, we only scheduled a two hour talk for each morning, leaving afternoons for informal discussions and collaborations, to enhance exchanges and collaborations within the UNIFY network. This followed the successful style of workshops practiced at the Aspen Center for Physics for more than 50 years. In fact, several research results have emerged from collaborations during the workshop.

The first week of the workshop was dedicated to the integrability structure of the AdS/CFT correspondence, and the second week, to exact techniques such as localization in supersymmetric gauge theories.

Approximately 50 researchers from Europe came to participate in the workshop, some of whom stayed at the Kavli IPMU for a few months and contributed to its research activities. Most of the researchers from abroad were supported by EU's Marie Curie Action, and the total cost for the Kavli IPMU was about half of its regular Focus Week.

Though the workshop turned out to be larger than we originally anticipated, it was very successful. We are grateful to the administrative staff members of IPMU for their dedicated service.

(Written by Hirosi Ooguri)

7.6 Holography and QCD—Recent Progress and Challenges—

Organizers

Michal P. Heller (Amsterdam/Warsaw)
Elias Kiritsis (APC/Crete)
Mukund Rangamani (Durham)
Jacob Sonnenschein (Tel Aviv)
Shigeki Sugimoto (Kavli IPMU, LOC, chair)
Taizan Watari (Kavli IPMU, LOC)
Hirosi Ooguri (Caltech/Kavli IPMU, advisor)

In the late 1990's, a mysterious duality called the "gauge/string duality" was discovered out of the research in string theory. The claim is that a gauge theory and string theory in a certain curved space-time can be physically equivalent. This duality is also called the "holographic dual," because it is a duality relating two theories in different space-time dimensions. From about 10 years ago, the application of this idea to QCD, which is the theory of strong interaction, has been discussed extensively. This workshop, held on September 24–28, is mainly focused on topics related to the research in this direction.

It has been shown that this new technology to analyze QCD using the holographic dual provides very useful and powerful tools to analyze the properties of hadrons and QCD, such as spectrum and interactions of hadrons, QCD phase structure, properties of quark gluon plasma realized at high temperature, and so on. In particular, one of the advantages of this approach is that it can be applied to the systems with time evolution and/or chemical potential, for which other non-perturbative methods like lattice QCD are not useful enough. In fact, it has attracted the attention of hadron physicists as well as string theorists and there have been fruitful interdisciplinary collaborations between string theorists and hadron physicists. One of the successes of the workshop was that we were able to gather together experts of both fields around the world, providing a good opportunity to interact with each other. There were many string theorists showing results in hadron physics and hadron theorists using holography and string theory. It was impressive to see that they were discussing and debating together toward common goals without a serious language barrier.

The topics discussed in the workshop include, calculations of hadron masses including the effects of electro-magnetic interactions, analysis in the Veneziano limit of QCD, descriptions of heavy hadrons, research on the systems with time evolutions that are aimed toward the application to the experiments of heavy ion collisions in RHIC and LHC, study of quark gluon plasma, various phenomena in the presence of strong electric and magnetic fields, phase structure with finite temperature and chemical potential, and so on. There were 25 talks in 5 days, and a lot of new interesting results on various topics related to holography and QCD were reported.

This workshop was supported by the European Science Foundation (Holograv network) and a Grant-in-Aid for Scientific Research on Innovative Areas 2303, MEXT, in addition to the WPI research funds at the Kavli IPMU. Finally, we would like to thank Ms. Ujita for the administrative support, which was crucial to make this workshop possible.

(Written by Shigeki Sugimoto)

Conferences

7.7 Symposium on Gravity and Light

Organizers

Amir Aazami (Kavli IPMU, LOC)
Shinji Mukohyama (Kavli IPMU, LOC)
Frederic Schuller (Albert-Einstein-Institute and Erlangen)
Marcus Werner (Kavli IPMU, LOC)

An international workshop called "Symposium on Gravity and Light" was held at the Kavli IPMU for four days, September 30 to October 3, 2013.

Light is our main source of information about the distant, early universe—indeed, until gravitational waves and extragalactic neutrinos can be observed directly and routinely, it is the only source. So in order to study the origin and evolution of the universe, it is fundamentally important to understand light propagation in spacetime under the influence of gravity alone, even before taking into account other astrophysical effects such as absorption. Hence, this workshop was dedicated to gravitational optics in a broad sense.

Black hole spacetimes were a major theme since the influence of gravity on light is, of course, seen most clearly when it is strong. Starting with optical geometry and the Gauss-Bonnet method (Marcus Werner), we discussed stable photon orbits, which are analogous to "whispering galleries" (Gary Gibbons), extreme trapping horizons of black holes (Tetsuya Shiromizu), and the properties and observability of black hole shadows (Kei-ichi Maeda and Volker Perlick).

Since the optical geometry of rotating Kerr black holes has Randers-Finsler structure, more general mathematical results on geodesics (Erasmo Caponio and Ricardo Gallego Torromé) and Killing vectors (Takayoshi Ootsuka) in Finsler geometry were presented as well. Mathematical aspects of gravitational lensing theory were also considered, in particular universal magnification invariants for ADE singularities (Amir Aazami), and magnification relations for perturbed singular isothermal quadrupole lenses (Zhe Chu).

Testing cosmology with gravitational lensing was another major theme and included a review of the recent controversy about the rôle of the cosmological constant in light bending (Masumi Kasai), lenses with negative convergence, which may be used as effective models for cosmic voids (Hideki Asada), as well as tests of the homogeneity postulate and observational prospects (Jean-Philippe Uzan). We also discussed the underlying gravity theory, in particular inflation (Misao Sasaki), and a new geometrodynamical framework to derive gravity actions, in which light dispersion relations are fundamental (Frederic Schuller).

Thus, in keeping with the interdisciplinary spirit of the Kavli IPMU, our workshop brought together astronomers, theoretical physicists and mathematicians, which did in fact result in rather lively and sometimes controversial discussions.

Finally, we would like to thank Kavli IPMU staff members, in particular Rie Ujita and Rie Kohama, for their administrative support.

(Written by Marcus Werner)

7.8 International Workshop on Next Generation Nucleon Decay and Neutrino Detectors (NNN13)

Local Organizing Committee

Yoshinari Hayato (ICRR)*
Junji Hisano (Nagoya)*
Kunio Inoue (Tohoku)*
Yoshitaka Itow (Nagoya)
Takashi Kobayashi (KEK)
Masahiro Kuze (Tokyo Tech)
Masayuki Nakahata (ICRR)*
Tsuyoshi Nakaya (Kyoto)*
Shoei Nakayama (ICRR)*
Kimihiro Okumura (ICRR)*
Masato Shiozawa (ICRR, co-chair)*
Hideyuki Suzuki (Tokyo U. of science)
Osamu Yasuda (Tokyo Metropolitan)
Masashi Yokoyama (U. Tokyo, co-chair)*

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Chang Kee Jung (Stony Brook)*
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Takaaki Kajita (ICRR)*

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Mauro Mezzetto (INFN)
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Nicholas P. Samios (BNL)
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Katsuo Tokushuku (KEK)
Stan Wojcicki (Stanford)
Marco Zito (CEA)

*Also at Kavli IPMU

Neutrino oscillation, discovered by the Super-Kamiokande collaboration in 1998, is the first evidence of the physics beyond the standard model of particle physics. Over more than a decade since then, the studies of neutrino oscillations have grown to be one of the central topics in particle physics. As yet, we have not reached full understanding of what neutrinos are telling us.

During 2011–2012, the discoveries of the electron neutrino appearance by the T2K experiment, to which the Kavli IPMU participates, and antineutrino disappearance by the three reactor experiments opened the door to the next stage. The determination of the last mixing angle θ_{13} with those experiments made it possible to approach the major goals of neutrino physics, search for CP asymmetry in neutrino sector, and determination of the mass hierarchy, in the near future.

Because of the tiny interaction probability, the instruments to detect and study neutrinos tend to be huge, like the Super-Kamiokande detector that uses 50,000 tons of pure water. In order to further advance the study of neutrino properties, next generation detectors with larger target mass and better performance have been intensively studied all over the world. In Japan, the Hyper-Kamiokande, a 1 megaton water Cherenkov detector, is proposed as the successor of Super-Kamiokande. Such detectors, if realized, will also have sensitivity to nucleon decays that are predicted in the Grand Unified Theories. In addition, they will give opportunities for research in broader field of science such as neutrino astrophysics and geophysics.

The workshop series, "International Workshop on Next Generation Nucleon Decay and Neutrino Detectors (NNN)," started back in 1999, has been providing a forum for researchers to discuss next generation nucleon decay and neutrino detectors towards their realization. The 14th NNN was held from November 11 to 13, 2013 at the Kavli IPMU with about 120 participants from 14 countries. There were 35 oral and more than 30 poster presentations covering all aspects of related research, from theoretical development to the results and prospects with current and future experiments, and R&D on detector technology, accelerator, and neutrino beams. Through intense and exciting discussion during three days of workshop, neutrino physicists exchanged ideas to develop the new generation of experiments.

We would like to thank the administrative staff members of the Kavli IPMU for their service. We are especially grateful to Ms. Rie Ujita for her support, which was indispensable to make this workshop possible.

(Written by Masashi Yokoyama)

Conferences

7.9 SUSY: Model-Building and Phenomenology

Organizers

Koichi Hamguchi (U. Tokyo)
Junji Hisano (Nagoya U.)
Masahiro Ibe (ICRR, U. Tokyo)
Shigeki Matsumoto (Kavli IPMU)
Takeo Moroi (U. Tokyo)
Tsutomu Yanagida (Kavli IPMU)

The workshop "SUSY: Model-Building and Phenomenology" was successfully conducted at the Kavli IPMU during December 2–4, 2013. Having a workshop dedicated to current situations and future prospects of supersymmetry (SUSY) model-buildings and their phenomenological studies was the most important and timely idea because of the following reasons. First, the recent discovery of a new boson and subsequent measurements of its properties at the CERN Large Hadron Collider experiment (LHC) indicates that the boson seems strongly to be the Higgs boson predicted by the standard model (SM). Next, no new physics signals, on the other hand, have been discovered at LHC, which provides very stringent constraints on SUSY models. Finally, no robust new physics signals have been detected at dark matter detection and flavor-related experiments, either. Because of the reasons, many SUSY models proposed before LHC were ruled out and people were required to build new SUSY models which are consistent with the new experimental results with taking care of the naturalness problem concerning the electroweak scale.

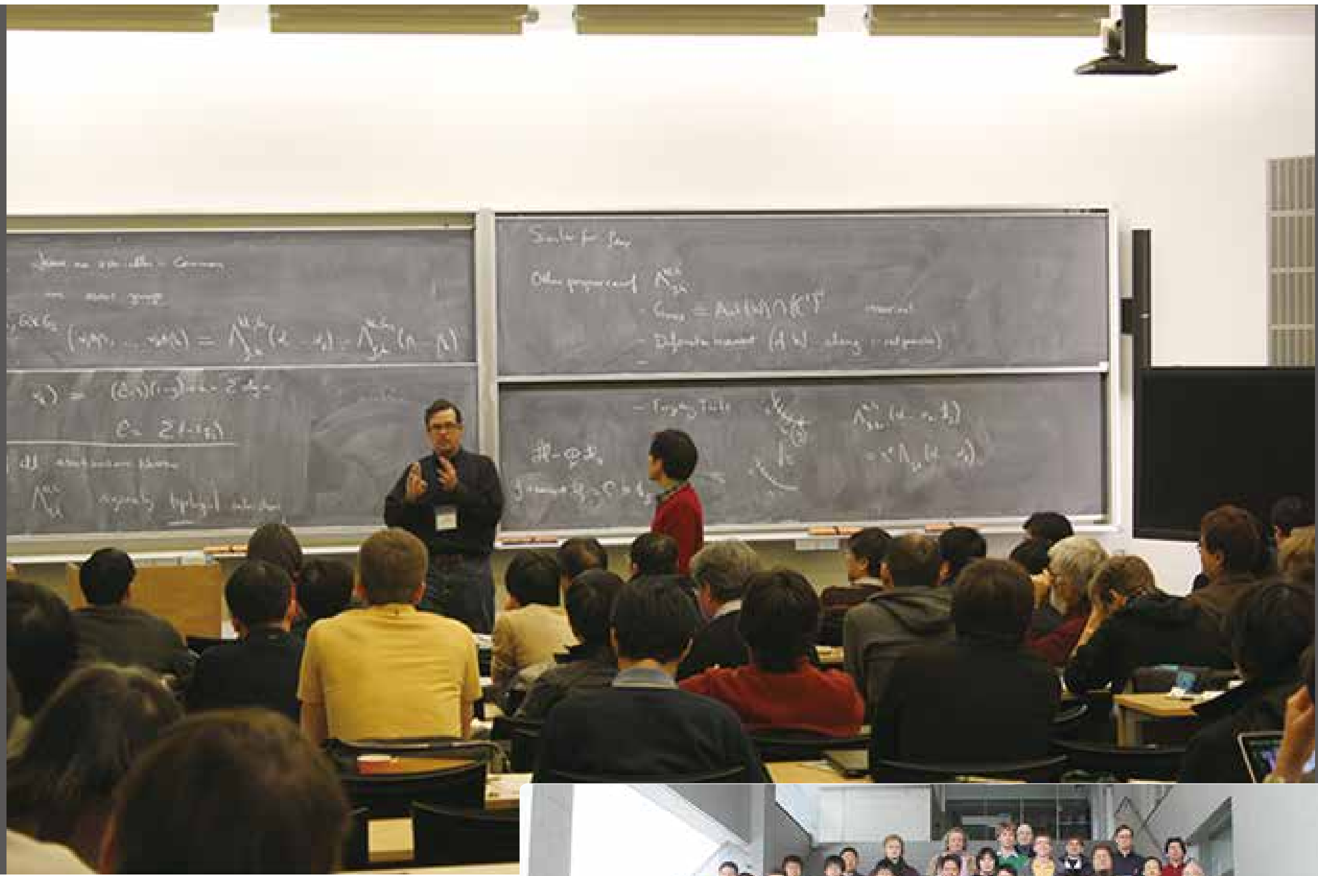
All of these issues were covered in great depth in the workshop, which included twelve plenary talks and seven contributed (short) talks. The workshop was launched by an opening talk by Kavli IPMU Director Hitoshi Murayama, where he gave a broad overview of the physics concerning new physics (SUSY) models. This was followed up with subsequent thorough talks by Graham Ross on several known SUSY models with focusing carefully on the fine-tuning problem, by Norimi Yokozaki on the focus-point scenario, by Philipp Kant on three-loop Higgs mass calculation in MSSM, by Joshua Ruderman on high-scale SUSY model, by Tomer Volansky on R-parity violating scenario, by Fuminobu Takahashi on SUSY cosmology, and by Masahiro Ibe on the pure gravity mediation model. There were also two experimental (ATLAS) talks by Shimpei Yamamoto and Naoko Kanaya discussing the current status and future prospects on SUSY searches at LHC. In addition, attractive non-SUSY scenarios were presented by Pyungwon Ko and Mikhail Shaposhnikov. Through the talks, participants could clearly understand the situation of SUSY (and non-SUSY) model-buildings and obtain a clue of promising future directions on this subject.

This workshop was originally planned to be a small one, but the number of participants was actually much more than we expected. This fact means that the topic of the workshop is now regarded as the most important one by almost all researchers in particle phenomenology, and having a similar workshop at the Kavli IPMU in the near future will be very important.

(Written by Shigeki Matsumoto)

Conferences

7.10 Workshop on “Primitive Forms and Related Subjects”



Organizers

Kentaro Hori (Kavli IPMU)
Changzheng Li (Kavli IPMU)
Si Li (Boston U.)
Kyoji Saito (Kavli IPMU)

A workshop on “Primitive Forms and Related Subjects” was held at the Kavli IPMU from February 10 to 14, 2014.

Let us give a brief historical overview on the subjects.

Modeled on the classical theory of elliptic integrals on a family of elliptic curves, the theory of period integrals of primitive forms over vanishing cycles of a function with isolated critical points was introduced in a work of K. Saito 1983. Here, a primitive form is defined to be a class of relative top degree differential forms on an open complex manifolds equipped with a deformation family of a function *F* having only isolated critical points, where the relative de Rham cohomology class of the primitive form should satisfy some infinite system of bilinear equations of higher residue pairings defined on a semi-infinite Hodge structure.

Primitive forms have been one of the subjects of the Math-String seminar and Topological Strings seminar at the Kavli IPMU for the reason that the theory of primitive forms is relevant for the complex geometric aspect (“B-model”) of the Landau-Ginzburg model whose superpotential is given by the function *F*. According to a postulate, called mirror symmetry in topological string theory, the theory should correspond to the symplectic geometric aspect (“A-model”) of another theory, such as the Gromov-Witten theory of a compact Kähler manifold or the Fan-Jarvis-Ruan-Witten theory (2007, 2013) of a Landau-Ginzburg orbifold.

As a consequence of the theory, a primitive form induces the flat structure on the deformation parameter space (i.e., a flat metric together with a ring structure on the tangent bundle of the parameter space satisfying some integrability conditions. The structure was later axiomatized as the Frobenius manifold structure by B. Dubrovin 1990). Then that structure defines a potential function called the prepotential on the parameter space. One mathematically rigorous formulation of the mirror symmetry conjecture asks that **the prepotential function obtained from a primitive form should coincides with that of the mirror side** (i.e., of Gromov-Witten theory or of FJRW theory) **after a suitable identification called the mirror map, of parameter spaces equipped with the flat coordinates**.

However, the verification of this mirror symmetry conjecture was not achieved until recently, since even though primitive forms are theoretically known to exist, their explicit expression was not known except for two cases: universal unfoldings of simple singularities and simple elliptic singularities (1983 K. Saito). Mirror symmetry for these two cases has been confirmed rather recently (simple singularity case, Fan-Jarvis-Ruan 2007, simple elliptic singularity case, Krawitz-Shen 2011, Milanov-Shen 2012).

In the last year, there have been new progresses:

1) Towards a construction of primitive forms over Novikov rings for toric cases (Fukaya-Oh-Ohta-Ono),
2) Unified approach to primitive forms and to BCOV-theory via polyvector fields (Li-Li-Saito),
3) Perturbative construction of primitive forms (Li-Saito).
   In particular, as an application of 3), we obtain
4) Verification of mirror symmetry for wide classes of singularities including cases with central charge being larger than 1, using the perturbative formula of prepotentials (Li-Li-Saito-Shen).

The workshop was inspired by these recent developments, and consisted of

(A) three basic courses
- Lecture I (given by K. Ono, H. Ohta, and K. Fukaya): Frobenius manifold structure and Lagrangean Foer theory for toric manifolds
- Lecture II (given by T. Jarvis): Introduction to FJRW-theory and a mathematical approach to the Gauged Linear Sigma Model
- Lecture III (given by Si Li): LG-model via Kodaira-Spencer gauge theory

(B) 10 research talks
- S. Barannikov: On the noncommutative Batalin-Vilkovisky formalism and EA matrix integrals
- A. Takahashi: From Calabi-Yau dg categories to Frobenius manifolds via primitive forms
- K. Hori, M. Romo: The parameter delta
- H. Fan: Analytic construction of quantum invariant of singularity
- Y. Zhang: On the genus two free energies for semi simple Frobenius manifolds
- A. Losev: K. Saito theory of primitive form, generalized harmonic theory and mirror symmetry
- H. Iritani: Gamma Conjecture for Fano manifolds
- Y. Shen: Mirror symmetry for exceptional unimodular singularities
- T. Milanov: The phase form in singularity theory
- D. Pomerleano: Deformation theory of affine symplectic manifolds

(C) 7 short communications
- Y. Shiraishi: On Weyl group and Artin group associated to orbifold projective lines
- N. Priddis: A Landau-Ginzburg/Calabi-Yau correspondence for the mirror quantic
- M.R. Rahmati: Hodge theory of isolated hypersurface singularities
- B. Bychkov: On the number of coverings of the sphere ramified over given points
- M. van Garrel: Integrality of relative BPS state counts of toric Del Pezzo surfaces
- S. Sugiyama: On the Fukaya-Seidel categories of surface Lefschetz fibrations
- A. Bondal and I. Zhdanovskiy: Critical points of a functional and orthogonal pairs of Cartan subalgebras.

There were over 80 participants from all over the world, including Asia, Russia, Europa and America, and the workshop was quite active and successful by showing the current status of the research and inspiring further study of primitive forms including 1) geometric understanding of mirror symmetry and 2) towards a categorical construction primitive forms.

(Written by Kyoji Saito)

7.11 Mini-Workshop on “Massive Gravity and Its Cosmological Implications”

Organizers

Yasuyuki Kawahigashi (U Tokyo)
Toshitake Kohno (U Tokyo)
Stefan Hollands (U Leipzig)

Supersymmetry is originally a notion in particle physics describing the symmetry between two basic classes of elementary particles: bosons, which have an integer valued spin; and fermions, which have a half integer valued spin. Supersymmetry is a recurring theme in theoretical physics to find a unified description of the fields and forces of nature. On the other hand, supersymmetry is an interesting structure also from the purely mathematical viewpoint, for example, as a natural and rich generalization of classical algebraic structures such as Lie algebras, or as realizations via special types of spinor fields on Riemannian or pseudo-Riemannian manifolds. The last theme is also intimately connected with classical and quantum field theories on curved spacetime with supersymmetry, which have recently attracted interest among both physicists and mathematicians.

The purpose of the workshop was to promote interaction between physicists and mathematicians in various aspects of supersymmetry. Among participants, there were theoretical physicists and mathematicians of various disciplines including the theory of operator algebras, representation theory and geometry. The workshop took place for 9 days from March 10–20, 2014, at the Kavli IPMU's Lecture Hall. There were in principle three talks per day, and we had a lot of time to discuss among physicists and mathematicians.

Main subjects discussed in the workshop were generalizations of Lie algebras and their representations, non-commutative geometry, cyclic cohomology, supersymmetric generalization of vertex operators, twistor spinors, conformal analogs of Calabi-Yau manifolds, etc.

The workshop was supported by the Kavli IPMU and “Frontiers of Mathematical Sciences and Physics” (FMSP), which is a part of the Program of Leading Graduate Schools, MEXT Japan.

(Written by Toshitake Kohno)

7.12 Peter Goddard Symposium

Peter Goddard (left) and Hitoshi Murayama (right), talking at the Symposium.

Organizer

Hirosi Ooguri (Kavli IPMU / Caltech)

Professor Peter Goddard is a distinguished mathematical physicist. He formulated the quantization of the relativistic string, proved the "no ghost theorem" of string theory, proposed the electromagnetic duality in non-abelian gauge theory, and provided remarkable evidences for it, introduced and studied a class of conformal field theory, which has become the foundation of our understanding of gauge symmetry in string theory. His seminal achievements in these areas provide important examples for researchers at the Kavli IPMU, who try to open new avenues of research at the interface between mathematics and physics.

Professor Goddard has also contributed in creating and maintaining environments for researchers. He played a leading role in establishing the Isaac Newton Institute for Mathematical Sciences at Cambridge University, where he was the Deputy Director. He was the Master of St. John's College, before becoming the eighth Director of the Institute for Advanced Study in Princeton. He stepped down from the position in 2012 and is currently a professor at the Institute.

Professor Goddard received the Dirac Prize and Medal from the International Center for Theoretical Physics in Trieste and is a Fellow of the Royal Society of London and a Commander of the Order of the British Empire.

Professor Goddard visited the Kavli IPMU in March and April, 2014. On this occasion, we organized a one-day symposium to celebrate his contribution in science. Some of the faculty members and affiliated members of the Kavli IPMU, who were visitors of the Newton Institute and members of the Institute for Advanced Study under his leadership, spoke at the symposium.

The Symposium opened with a talk by Hitoshi Murayama, the Director of the Kavli IPMU, on his recent work on geometry of non-relativistic Goldstone bosons. This work generalizes Nambu's work on spontaneous symmetry breaking in nontrivial ways.

Tohru Eguchi of Rikkyo University spoke on the Mathieu Moonshine, a joint work with Hirosi Ooguri and Yuji Tachikawa of the Kavli IPMU. This work originated from the work of Eguchi and Ooguri, 25 years ago, with Anne Taormina and Sung-Kil Yang. 21 years after this original work, a chance encounter of Eguchi with Ooguri and Tachikawa in 2010 led to a discovery of the remarkable connection between K3 geometry and the largest Mathieu group M24.

Kentaro Hori of the Kavli IPMU also talked about his PhD thesis published 20 years ago, which turned out to have significant implications of current theoretical research. Yuji Tachikawa talked about instantons and string theory and Simeon Hellerman on string theory of the Regge intercept. The Symposium ended with a talk by Peter Goddard himself on the formula of Cachazo, He, and Yuan for Yang-Mills tree amplitudes.

The speakers chose their topics to fit with the range of research activities of Peter Goddard, and there were lively discussions during coffee breaks and lunch. On the day after the symposium, the Kavli IPMU recorded a conversation of Peter Goddard with Hitoshi Murayama and Hirosi Ooguri on research at the interface of physics and mathematics. Its transcript appears in two parts (Part I in No. 26 and Part II in No. 27) of the Kavli IPMU News.

(Written by Hirosi Ooguri)

7.13 The 3rd and 4th Open Meetings for the Hyper-Kamiokande Project

~100 participants to the 4th Hyper-K meeting.

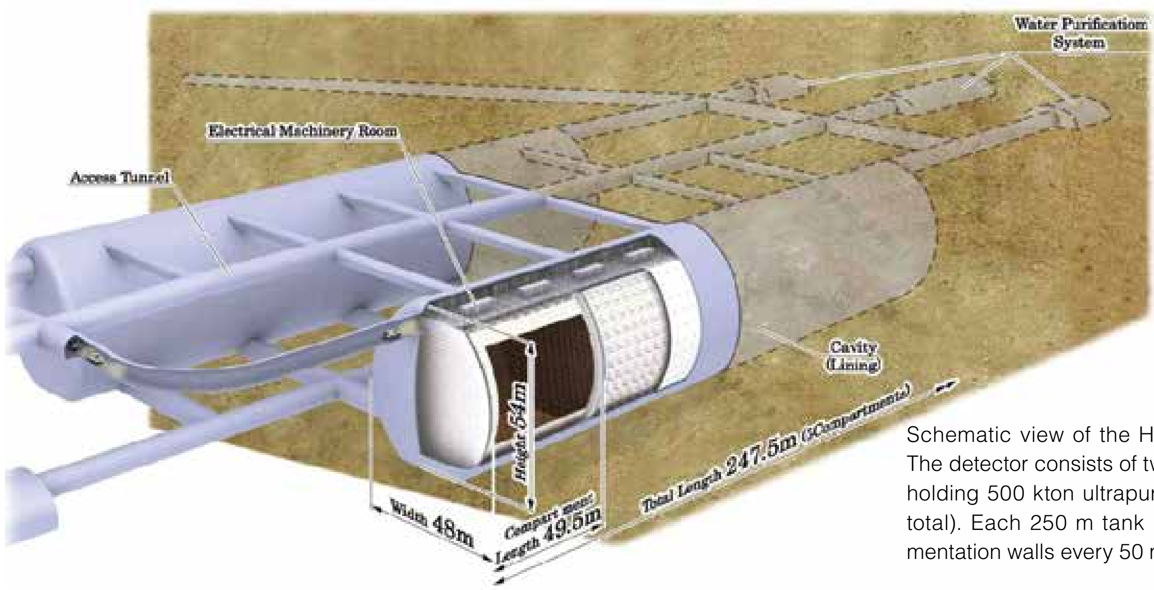
The 3rd Meeting Organizing Committee

Yoshinari Hayato (ICRR)*, Yusuke Koshio (Okayama)*, Neil McCauley (Liverpool), Akihiro Minamino (Kyoto), Shun-ichi Mine (UCI), Makoto Miura (ICRR)*, Tsuyoshi Nakaya (Kyoto)*, Shoei Nakayama (ICRR)*, Yasuhiro Nishimura (ICRR), Kimihiro Okumura (ICRR)*, Hiroyuki Sekiya (ICRR)*, Masato Shiozawa (ICRR, chair)*, Yasuo Takeuchi (Kobe)*, Hidekazu Tanaka (ICRR), Hirohisa Tanaka (UBC), Mark Vagins (Kavli IPMU), Roger Wendell (ICRR)*, Masashi Yokoyama (Tokyo)*

The 4th Meeting Organizing Committee

Francesca Di Lodovico (QMUL), Mark Hartz (Kavli IPMU), Yoshinari Hayato (ICRR)*, Yusuke Koshio (Okayama)*, Neil McCauley (Liverpool), Akihiro Minamino (Kyoto), Shun-ichi Mine (UCI), Makoto Miura (ICRR)*, Tsuyoshi Nakaya (Kyoto)*, Shoei Nakayama (ICRR)*, Yasuhiro Nishimura (ICRR), Kimihiro Okumura (ICRR)*, Hiroyuki Sekiya (ICRR)*, Masato Shiozawa (ICRR, chair)*, Yasuo Takeuchi (Kobe)*, Hidekazu Tanaka (ICRR), Hirohisa Tanaka (UBC), Mark Vagins (Kavli IPMU), Chris Walater (Duke)*, Roger Wendell (ICRR)*, Masashi Yokoyama (Tokyo)*

*Also at Kavli IPMU



Schematic view of the Hyper-Kamiokande. The detector consists of two cylindrical tanks holding 500 kton ultrapure water (1 Mton in total). Each 250 m tank is divided by segmentation walls every 50 m.

The Hyper-Kamiokande will be the 3rd generation water Cherenkov detector at Kamioka and is being designed to be the next decade's flagship experiment for the study of neutrino oscillations, nucleon decays, and astrophysical neutrinos. After the discovery of electron neutrino appearance in muon neutrino beam in the T2K experiment, world neutrino community has consensus that the next target of experimental neutrino oscillation study is possible CP asymmetry of neutrinos that Hyper-Kamiokande project is aiming to discover. The international working group has been formed at the 1st Hyper-Kamiokande meeting in 2012 and we have two meetings every year since then.

The 3rd and 4th meetings for the Hyper-Kamiokande project took place at the Kavli IPMU in fiscal year 2013. The 3rd meeting was held from June 21 to 22, 2013 and 4th one from January 27 to 28, 2014. The meeting program and presentation files are available at the URL:
http://indico.ipmu.jp/indico/conferenceDisplay.py?ovw=True&confId=23
http://indico.ipmu.jp/indico/conferenceDisplay.py?ovw=True&confId=29
The number of participants was over 100 for both meetings including foreign participants from Canada, France, Korea, Russia, Switzerland, UK, and US. The meetings have been open to all interested scientists and community members and all presentation slides are open to public. It is our firm intention to make the Hyper-K project completely open to the international community and contribute to the worldwide effort to make future neutrino physics program strong.

The goal of the meetings is to discuss the physics potentials of Hyper-K, the design of the detector, and necessary R&D items including cavern excavation, tank liner material and its design, photo-sensors and their support structure, DAQ electronics and computers, calibration systems, water purification systems, software development, and so on. One of big challenges of the detector is to excavate world largest underground cavity and build 1 million ton water tank in it. We made an optimal conceptual design, corresponding construction schedule and cost estimation for them. The group aims to proceed to a full geological survey of the candidate site for making a detailed design and start the detector construction. A photo-sensor is also a key element of the detector. It would be critical to develop cheap and high-performance sensors. It was reported that new photo-sensor development works in Japan and US are going on schedule. New photo-sensors would have 30% higher sensitivity and much better timing resolution than the photomultipliers being used in the Super-Kamiokande.

The meeting discussion extends to near neutrino detectors to be located at 1–2 km away from the neutrino production target at the J-PARC. The detector, if we construct, would play a central role to understand the J-PARC neutrino beam property and neutrino-nucleus interactions both of which would be indispensable to provide convincing results on CP asymmetry. Extensive study on the near-detector design and relevant physics sensitivity is going on these days. In the 4th meeting, a team has been formed for writing a letter-of-intent for the CP asymmetry study.

Moreover, discussions were made on working group organization, international participations and their responsibilities, and ongoing project prioritization activities in Japan and other countries. The Hyper-Kamiokande project is now in a turning point and the working group members are accelerating the works to define and realize the project.

(Written by Masato Shiozawa)

8 Seminars

FY2013

Yusuke Nakamura (U Tokyo)
On semi-continuity problems for minimal log discrepancies
Apr 02, 2013

Thomas Creutzig (TU Darmstadt)
Logaritmic conformal field theory and the Verlinde formula
Apr 03, 2013

Yasunori Nomura (UC Berkeley)
Complementarity or Firewalls: the Emergence of Classical Worlds
Apr 05, 2013

David Ridout (Australian National U)
A (Working) Verlinde Formula for Fractional Level WZW Models
Apr 09, 2013

Xiaoyuan Huang (NAOC)
The Gamma Ray Line and Some Tests
Apr 10, 2013

Andrew Bunker (U Oxford)
The First billion years of History—Star-forming galaxies at the end of the dark ages
Apr 10, 2013

Robert Caldwell (Dartmouth College)
Ideas for lab tests of dark energy
Apr 11, 2013

Kimitake Hayasaki (Korea Astronomy and Space Science Institute)
Tidal disruption flares from stars on eccentric orbits
Apr 11, 2013

Daniel Michael Pomerleano (Kavli IPMU)
Symplectic cohomology and mirror symmetry
Apr 11, 2013

Shunji Matsuura (McGill U)
Renyi entropy and Entanglement spectrum
Apr 16, 2013

Ryosuke Itoh (KEK)
Search for New Physics at Belle II by Global Fit
Apr 17, 2013

Norihiro Tanahashi (Kavli IPMU)
Horizon instability of an extreme Reissner-Nordstrom black hole
Apr 17, 2013

Satoshi Yamaguchi (Osaka U)
Supersymmetric Boundary Conditions in Three Dimensional N = 2 Theories
Apr 19, 2013

Hiroko Miyahara (ICRR)
Possible Effects of Galactic Cosmic Rays on Climate and Weather
Apr 22, 2013

Mitsutoshi Fujita (IPMU/Washington U)
Dualities through the orbifold equivalence in Chern-Simons-matter theories
Apr 23, 2013

Tsutomu Yanagida (Kavli IPMU)
An Introduction of the Higgs Particle to Astrophysicist and Mathematician
Apr 24, 2013

Atsushi Kanazawa (U British Columbia)
Calabi-Yau threefolds of Type K
Apr 24, 2013

Andrei Pajitnov (U Nantes)
Novikov homology and its geometric applications
Apr 25, 2013

Mauricio Andres Romo Jorquera (Kavli IPMU)
Topological-antitopological fusion and gauged linear sigma models
Apr 25, 2013

Todor Milanov (Kavli IPMU)
An introduction to the theory of primitive forms (Part 1)
Apr 26, 2013

Todor Milanov (Kavli IPMU)
An introduction to the theory of primitive forms (Part 2)
Apr 26, 2013

Sho Iwamoto (Kavli IPMU)
SUSY (with explaining the muon g-2 anomaly) at the LHC
May 01, 2013

Takahiro Tanaka (YITP, Kyoto U)
Possible existence of viable models of bi-gravity with detectable graviton oscillations by gravitational wave detectors
May 02, 2013

Kunio Kaneta (Kavli IPMU)
Parity violation in QCD process via SUSY
May 08, 2013

Kazuyuki Sugimura (YITP, Kyoto U)
Quantum tunneling in the inflationary era and its observational consequences
May 09, 2013

Katsuyuki Naoi (Kavli IPMU)
Finite-dimensional representations over a quantum loop algebra and their classical limits
May 09, 2013

Amir Aazami (Kavli IPMU)
The singularity theorems in general relativity I
May 10, 2013

Takeshi Morita (KEK)
Quantum quench in matrix models: Dynamical phase transitions, equilibration and the Generalized Gibbs Ensemble
May 10, 2013

Alvio Renzini (INAF)
The SFR-M* relation from low to high redshift
May 13, 2013

Natsumi Nagata (Nagoya U)
Minimal SUSY SU(5) GUT in the high-scale SUSY scenario
May 15, 2013

Alvio Renzini (INAF)
Structure and kinematics of starforming galaxies at z~2
May 15, 2013

Kantaro Omori (U Tokyo)
Superstring theory and integrations over moduli space
May 15, 2013

Lisa Kewley (ANU)
Galaxy Formation and evolution through Metals
May 16, 2013

Amir Aazami (Kavli IPMU)
The singularity theorems in general relativity II
May 17, 2013

Masanori Okawa (Hiroshima U)
Twisted space-time reduction in large N QCD with adjoint Wilson fermions
May 20, 2013

Ziming Nikolas Ma (CUHK)
Witten deformation and Morse category
May 20, 2013

Ryuichiro Kitano (KEK)
Color Confinement and Emergent Higgs
May 22, 2013

Gary Hill (McDonald Observatory)
The Hobby-Eberly Telescope Dark Energy Experiment
May 22, 2013

Tomoko Iwashita (Nara Women's U)
Search for C-odd partner of X(3872) at Belle
May 23, 2013

Shunsuke Tsuchioka (Kavli IPMU)
Khovanov-Lauda-Rouquier algebras and the symmetric groups (survey)
May 23, 2013

Amir Aazami (Kavli IPMU)
The singularity theorems in general relativity III
May 24, 2013

Stefan Hoeche (SLAC)
Precision Event Generation for LHC Physics
May 29, 2013

Markus Rummel (DESY)
Construction of Explicit de Sitter vacua in Type IIB Flux compactifications
Jun 04, 2013

Yi Wang (Kavli IPMU)
Usage of Mathematica Beyond a Calculator
Jun 04, 2013

Yefeng Shen (Kavli IPMU)
Global mirror symmetry for invertible simple elliptic singularities
Jun 06, 2013

David R. Morrison (UCSB)
The Gamma class and perturbative sigma models
Jun 07, 2013

Francois R. Bouchet (IAP)
First cosmological results from the Planck satellite
Jun 07, 2013

Morimichi Kawasaki (U Tokyo)
Displaceability of Lagrangian submanifolds and Hamiltonian Floer theory
Jun 11, 2013

Cumrun Vafa (Harvard U)
M-strings
Jun 11, 2013

Saurabh Rindani (INSA)
Study of top-quark anomalous couplings through polarization
Jun 12, 2013

Akira Ukawa (U Tsukuba)
Lattice QCD – achievements and perspectives
Jun 12, 2013

Thatagata Basak (Iowa State U)
Computing the fundamental group of a Complex hyperbolic orbifold
Jun 13, 2013

Sachiko Tsuruta (Montana State U)
Neutron Star Thermal Evolution and Properties of Ultra-High Density Matter
Jun 13, 2013

Marcus Werner (Kavli IPMU)
New applications of de-Sitter geometry in astrophysics I
Jun 13, 2013

Takao Nakagawa (JAXA)
The next-generation infrared space mission SPICA
Jun 13, 2013

Shlomo S. Razamat (IAS)
3d dualities from 4d dualities
Jun 14, 2013

Barry Wardell (U College Dublin)
Green function approach to self-force calculations
Jun 18, 2013

Bengt Nilsson (Chalmers U of Technology)
New 3d CFTs with 8 supersymmetries from topological gauging
Jun 18, 2013

Anzhong Wang (Baylor U)
Gravitational collapse in Horava-Lifshitz theory of Gravity
Jun 19, 2013

Tsuyoshi Houri (Rikkyo U)
Killing-Yano symmetry of higher-dimensional black holes
Jun 20, 2013

Satoshi Kondo (Kavli IPMU)
On the higher Chow group of product of curves
Jun 20, 2013

Hsian-Hua Tseng (Ohio State U)
Counting disks in toric varieties
Jun 24, 2013

Miguel S. Costa (U Porto)
High Energy Scattering in AdS/CFT – Applications to N = 4 SYM and to low-x QCD
Jun 25, 2013

Sung-Chul Yoon (Seoul National U)
Progenitors of Type Ibc supernovae
Jun 26, 2013

Marcus Werner (Kavli IPMU)
New applications of de-Sitter geometry in astrophysics II
Jun 27, 2013

Martin Spinrath (SISSA)
Natural GUT scale mass ratios
Jun 27, 2013

Puragra Guhathakurta (UC Santa Cruz)
The Andromeda Galaxy: Hierarchical Galaxy Formation, Stellar Populations, and the Interstellar Medium
Jun 27, 2013

Zheng Hua (U Hong Kong)
Orientation data and quantization
Jul 01, 2013

Masaki Mori (U Tokyo)
Cellular structure on the Hecke-Clifford superalgebras
Jul 02, 2013

Koh Takahashi (U Tokyo)
Evolution of the most massive asymptotic giant branch star as a progenitor for electron capture supernovae
Jul 04, 2013

David Farris (Indian Institute of Science)
Embedded contact homology of circle bundles
Jul 04, 2013

Claudia Hagedorn (U Padua)
CP and Flavor Symmetries: Ideas and Models
Jul 08, 2013

Matt Malkan (UCLA)
New Views of Galaxy Evolution: The Young and The Dusty
Jul 08, 2013

Richard Eager (Kavli IPMU)
Elliptic genera and two dimensional gauge theories
Jul 08, 2013

Bomsoo Kim (Tel Aviv U)
Universal hydrodynamic description of quantum critical points with Lifshitz scaling
Jul 09, 2013

Michael Gary (TU Wien)
Higher Spin 3d Gravity: Beyond AdS
Jul 10, 2013

Kazushi Ueda (Osaka U)
Dimer models and homological mirror symmetry
Jul 11, 2013

Kwok-Wai Chan (CUHK)
SYZ for local mirror symmetry
Jul 12, 2013

Nils Carqueville (Simons Center)
Topological defects and generalised orbifolds
Jul 16, 2013

Hideki Maeda (Rikkyo U, CECs)
Gauss-Bonnet braneworld redux: A novel scenario for the bouncing universe
Jul 16, 2013

Ignatios Antoniadis (CERN)
Mass hierarchy and physics beyond the Standard Model
Jul 17, 2013

Martin White (UC Berkeley)
Cosmic sound, near and far
Jul 17, 2013

Daniel Pomerleano (Kavli IPMU)
Homological Mirror Symmetry for toric Calabi-Yau varieties
Jul 17, 2013

Peter Behroozi (Stanford U)
How Galaxies are Made, from z=0 to z=8
Jul 18, 2013

Tomohisa Takimi (Tata)
Phase structures of Chern-Simons matter theory on $S^2 \times S^1$
Jul 18, 2013

Si Li (Boston U)
B-twisted sigma-model and Calabi-Yau geometry
Jul 22, 2013

Sheel Ganatra (Stanford U)
Symplectic cohomology and duality for the wrapped Fukaya category
Jul 23, 2013

Kentaro Mawatari (Vrije Universiteit Brussel)
Higgs characterisation framework
Jul 24, 2013

Joergen E. Andersen (Aarhus U)
Non-abelian theta functions and unitarity of the hitchin connection
Jul 24, 2013

Maksim Maydanskiy (Stanford U)
Floer theory on Lefschetz fibrations and empty symplectic manifolds
Jul 25, 2013

Mao Sheng (USTC)
Nonabelian Hodge theory in positive characteristic
Jul 25, 2013

Frank Vandenbosch (Yale U)
New Insights regarding the Stellar Mass Assembly of Galaxies across Cosmic Time
Aug 01, 2013

Vladimir Bazhanov (ANU)
A master solution of the quantum Yang-Baxter equation and classical discrete integrable equation
Aug 05, 2013

Moshe Rozali (U British Columbia)
Inhomogeneous Holography
Aug 05, 2013

Yuuki Shiraishi (Osaka U)
Primitve forms for affine cusp polynomials
Aug 06, 2013

Bernard Carr (Queen Mary U London)
Black Holes and the Generalized Uncertainty Principle
Aug 07, 2013

Yuuki Shiraishi (Osaka U)
A uniqueness theorem for Frobenius manifolds and Gromov-Witten theory for orbifold projective lines
Aug 08, 2013

Yoshiki Oshima (Kavli IPMU)
Branching laws for discretely decomposable restrictions
Aug 15, 2013

Mikhail Kapranov (Yale U)
Triangulated surfaces in triangulated categories
Aug 23, 2013

Anatoly Kirillov (RIMS, IPMU)
Dunkl operators
Aug 26, 2013

Vassily Gorbounov (U Aberdeen)
Young-Baxter algebras and Quantum Cohomology
Aug 27, 2013

Shinya Wanajo (NAOJ)
Nucleosynthesis beyond iron: supernovae vs. neutron star mergers
Aug 27, 2013

Emil Khabiboulline (Caltech)
How Does Galaxy Environment Influence AGN Activity?
Aug 28, 2013

Josh Speagle (Harvard U)
The Evolution of Star-Forming Galaxies Over Cosmic Time
Aug 28, 2013

Chan Y. Park (Caltech)
BPS spectrum of Argyres-Douglas theory via spectral network
Sep 10, 2013

Shimpei Yamamoto (ICEPP/CERN)
SUSY searches based on long-lived particle signatures at the LHC
Sep 11, 2013

Todor Eliseev Milanov (Kavli IPMU)
Affine Artin groups
Sep 12, 2013

Vladimir Mitev (Humboldt U)
Spectra of coset sigma models
Sep 17, 2013

Atsushi Kanazawa (U British Columbia)
Calabi-Yau 3-folds with infinite fundamental group and mirror symmetry
Sep 24, 2013

Ran Huo (Kavli IPMU)
Electroweak Baryogenesis beyond the high temperature expansion
Sep 25, 2013

Valentin Tonita (Kavli IPMU)
Reconstruction and convergence results in quantum K-theory
Sep 26, 2013

Michael Wemyss (U Edinburgh)
Noncommutative Deformations of curves and spherical twists
Sep 30, 2013

Francesco Nitti (APC, Université Paris 7)
Holographic Quantum Effective Actions
Oct 01, 2013

Marc Davis (UC Berkeley)
Large Scale Structure – Cosmic Flows
Oct 02, 2013

Roberto Percacci (SISSA)
Introductory course on functional renormalization group I
Oct 04, 2013

Jens Chluba (Johns Hopkins U)
Science with CMB spectral distortions: a new window to the early Universe
Oct 04, 2013

Lance Labun (LeCosPa)
Photons from a QCD phase transition in neutron star mergers
Oct 04, 2013

Nathaniel Craig (Rutgers U)
Theories of Natural Supersymmetry
Oct 07, 2013

Osamu Iyama (Nagoya U)
Tilting theory on Geigle-Lenzing weighted projective spaces
Oct 07, 2013

Yu Nakayama (IPMU/Caltech)
Vector Beta Function
Oct 08, 2013

Roberto Percacci (SISSA)
Introductory course on functional renormalization group II
Oct 09, 2013

Satoshi Iso (KEK)
An implication of 126 GeV Higgs boson for Planck scale physics – naturalness and the stability of the vacuum
Oct 09, 2013

Roberto Percacci (SISSA)
Introductory course on functional renormalization group III
Oct 10, 2013

Gil Holder (McGill U)
Gravitational Lensing of the CMB: Mass Maps, Power Spectra, and B-modes with the South Pole Telescope
Oct 10, 2013

Jesse Wolfson (Northwestern U)
Index Theory in Algebraic K-Theory and Algebraic Geometry
Oct 10, 2013

Roberto Percacci (SISSA)
Asymptotic safety: motivations and results
Oct 11, 2013

Ritoban Thakur (U Illinois Urbana Champaign)
CDMSlite: A Search for Light WIMPs
Oct 11, 2013

Yunfeng Jiang (Saclay)
Correlation Functions in N = 4 SYM from Integrability
Oct 15, 2013

Gyo Takeda (Tohoku U)
How we can learn and use languages freely? —study of human faculty of languages and mathematics—
Oct 16, 2013

Keiichi Maeda (Kyoto U)
Signatures of a companion star in type Ia supernovae
Oct 17, 2013

Xian Gao (Titech)
Heavy modes and the oscillatory features in the curvature power spectrum
Oct 18, 2013

Adam Burrows (Princeton U)
Lecture 1: Progress Towards the Core-Collapse Supernova Mechanism
Oct 22, 2013

Adam Burrows (Princeton U)
Lecture 2: Core-Collapse Supernovae and Diagnostics: Some Observables and Diagnostics
Oct 22, 2013

Adam Burrows (Princeton U)
Spectra and Photometry: Windows into Exoplanet Atmospheres
Oct 23, 2013

Adam Burrows (Princeton U)
Lecture 3: Brown Dwarfs: 20 Years Later
Oct 24, 2013

Ian Parrish (CITA)
Galaxy Clusters from Inside to Out: Thermal Instability and Non-thermal Pressure Support
Oct 24, 2013

Tirasan Khandhawit (Kavli IPMU)
Stable homotopy type of Seiberg-Witten monopole Floer homology
Oct 24, 2013

Bumsig Kim (KIAS)
Orbifold Quasimap Theory
Oct 28, 2013

Sanefumi Moriyama (KMI, Nagoya U)
Instanton Effects in ABJM Theory
Oct 29, 2013

Ferenc Szollosi (Tohoku U)
Equiangular Lines in Real Euclidean Spaces and Seidel Matrices with Three Distinct Eigenvalues
Oct 29, 2013

Rampei Kimura (RESCEU)
Derivative interactions in dRGT massive gravity
Oct 29, 2013

Walter Winter (Universitat Wuerburg)
Gamma-ray bursts as the sources of the ultra-high energy cosmic rays?
Oct 30, 2013

Knud Jahnke (MPIA)
Why do super-massive black holes accrete?
Oct 30, 2013

Yue-Lin Sming Tsai (Kavli IPMU)
MSSM Neutralino signature
Nov 01, 2013

Charles Siegel (Kavli IPMU)
Minicourse on the Madsen-Weiss Theorem [Part 1]
Nov 05, 2013

Jonathan Maltz (Kavli IPMU)
A physical introduction to conformal blocks
Nov 05, 2013

Samuel Jones (Keele U)
Evolution of electron capture supernova progenitors: new models, improved nuclear physics and hydrodynamic mixing uncertainties
Nov 05, 2013

Charles Siegel (Kavli IPMU)
Minicourse on the Madsen-Weiss Theorem [Part 2]
Nov 06, 2013

Yoshiharu Kawamura (Shinshu U)
Naturalness, Conformal Symmetry and Duality
Nov 06, 2013

Vijay Ravikumar (Tata Institute of Fundamental Research)
Triple Intersection Formulas for Isotropic Grassmannians
Nov 06, 2013

Alan Weinstein (UC Berkeley)
Linear canonical relations and their quantization
Nov 06, 2013

Charles Siegel (Kavli IPMU)
Minicourse on the Madsen-Weiss Theorem [Part 3]
Nov 07, 2013

James Michael Wallbridge (Kavli IPMU)
Some foundations of extended quantization
Nov 07, 2013

Charles Siegel (Kavli IPMU)
Minicourse on the Madsen-Weiss Theorem [Part 4]
Nov 08, 2013

Jason Evans (U Minnesota)
The Moduli and Gravitino (non)-Problems in Models with Strongly Stabilized Moduli
Nov 08, 2013

Satoshi Mochizuki (Chuo U)
Higher derived categories of relative exact categories and non-connective K-theory
Nov 12, 2013

Tadashi Takayanagi (YITP, Kyoto U)
Entanglement Renormalization and Black Holes in AdS/CFT
Nov 12, 2013

Simon Wood (Kavli IPMU)
Conformal Blocks and the Ising Model
Nov 12, 2013

Rouven Essig (Stony Brook U)
The Search for sub-GeV Dark Matter
Nov 15, 2013

Timothy Logvinenko (Cardiff U)
Spherical DG-functors
Nov 18, 2013

Mauricio Romo (Kavli IPMU)
Exact Results in Two-Dimensional (2,2) Supersymmetric Gauge Theories with Boundary
Nov 18, 2013

Alexander Voronov (U Minnesota)
DW theory using cohomology with coefficients in Picard groupoids
Nov 19, 2013

Takuya Okuda (U Tokyo)
Exact results for boundaries and domain walls in 2d supersymmetric theories
Nov 19, 2013

Jesse Wolfson (Northwestern U)
Loop Groups and Conformal Blocks
Nov 19, 2013

Fabiola Gianotti (CERN)
Challenges and accomplishments of the ATLAS experiment at the Large Hadron Collider
Nov 20, 2013

Christopher Marks (U Alberta)
The bounded denominator conjecture for vector-valued modular forms
Nov 21, 2013

Toru Yamada (Tohoku U)
WISH: Wide-field Imaging Surveyor for High-redshift
Nov 21, 2013

Norbert Christlieb (Heidelberg U)
The chemical abundance patterns of the most metal-poor stars
Nov 22, 2013

Anna Frebel (MIT)
Finding the most metal-poor stars with SkyMapper and first results, including a [Fe/H] < -7 star
Nov 22, 2013

Shinnosuke Okawa (Osaka U)
Non-existence of semi-orthogonal decompositions and sections of the canonical bundle
Nov 25, 2013

Susanne Reffert (CERN)
Deformed supersymmetric gauge theories from string- and M-theory (Part I): Introduction to the fluxtrap background
Nov 26, 2013

Domenico Orlando (École Normale Supérieure)
Deformed supersymmetric gauge theories from string- and M-theory (Part II): Applications
Nov 26, 2013

Masaaki Hayashida (ICRR, U Tokyo)
Future high-energy gamma-ray observatory: Cherenkov Telescope Array (CTA)
Nov 27, 2013

Danilo Marchesini (Tufts U)
New Insights into the Formation and Evolution of the Most Massive Galaxies
Nov 27, 2013

Changzheng Li (Kavli IPMU)
Primitive forms via polyvector fields
Nov 28, 2013

Myeonghun Park (Kavli IPMU)
Re-interpreting kinematic variables in the LHC searches
Nov 29, 2013

Heeyeon Kim (KIAS)
Exact Partition Functions on RP2 and Orientifolds
Dec 03, 2013

Mikhail Shaposhnikov (EPFL)
Asymptotic safety of the Standard Model and the Higgs boson mass
Dec 04, 2013

Fedor Smirnov (LPTHE)
Reflection relations and fermionic basis
Dec 05, 2013

Konstantin Belov (UCLA)
The Dark Past and Bright Future of Radio Detection of UHECRs
Dec 05, 2013

Tanmay Deshpande (Kavli IPMU)
Etale cohomology, ℓ-adic sheaves and Deligne-Lusztig theory
Dec 05, 2013

Seung-Joo Lee (KIAS)
An Algorithmic Approach to Heterotic String Phenomenology
Dec 06, 2013

Berndt Mueller (Duke U)
Equilibrating the Quark-Gluon Plasma: Flow, Fluctuations and Thermalization
Dec 09, 2013

Giorgio Torrieri (Columbia U)
Phase transitions in high density Yang-Mills matter
Dec 09, 2013

Nils Halverson (U Colorado)
Cosmology with the South Pole Telescope
Dec 11, 2013

Aravind Natarajan (U Pittsburgh)
Searching for Dark Matter through Radio Observations: Present and Future
Dec 12, 2013

Ilya Karzhemanov (Kavli IPMU)
Some uses of entropy in birational geometry
Dec 12, 2013

Moshe Rozali (U British Columbia)
Holographic topological insulators and superconductors
Dec 12, 2013

Ulrich Heinz (Ohio State U)
The Little Bang Standard Model
Dec 13, 2013

Sachiko Tsuruta (Montana State U)
Testing Strong Gravity with X-Ray Spectroscopy of AGN
Dec 13, 2013

Aron Wall (UCSB)
Why is the generalized second law true?
Dec 17, 2013

Alan Stapledon (U Sydney)
Representations on the cohomology of hypersurfaces and mirror symmetry
Dec 18, 2013

Toshifumi Futamase (Tohoku U)
WH expansion applied for the Non-linear Dark Matter Power Spectrum and its Applications
Dec 19, 2013

Jisuke Kubo (Kanazawa U)
Scale Invariant Extension of the Standard Model with QCD-like hidden sector and composite Dark Matter
Dec 20, 2013

David Morrison (UCSB)
Classification of 6D SCFTs
Jan 14, 2014

Wei Li (AEI)
Modular family of 3D higher-spin theory
Jan 14, 2014

Ivan Ip (Kavli IPMU)
Quantum Liouville's Theory and Modular Double of Uq(sl(2,R))
Jan 14, 2014

Takashi Hosokawa (U Tokyo)
Formation of First Stars
Jan 15, 2014

Surhud More (Kavli IPMU)
The weak lensing and clustering of SDSS III galaxies: from astrophysics to cosmology
Jan 16, 2014

Tomoyuki Abe (Kavli IPMU)
Crystalline companion of ℓ-adic sheaves
Jan 16, 2014

Tai-jun Chen (U Cambridge)
Stabilization of Linear Higher Derivative Gravity with Constraints
Jan 17, 2014

Corneliu Sochichiu (GIST)
Dirac graphs
Jan 21, 2014

Cornelius Schmidt (Kavli IPMU)
Recurrence (and resummation) of conformal blocks
Jan 21, 2014

Lisa Randall (Harvard U)
Double Disk Dark Matter
Jan 24, 2014

Yukiko Konishi (Kyoto U)
Local quantum cohomology and mixed Frobenius Structure
Jan 27, 2014

Makoto Miura (Tokyo U)
Mirror symmetry for minuscule Schubert complete intersections
Jan 28, 2014

Richard Ellis (Caltech)
Observations of Star Forming Galaxies in the Heart of the Reionization Era
Jan 28, 2014

Charles Siegel (Kavli IPMU)
CohFT and conformal blocks, or, how I learned to stop worrying and compute all the Chern classes
Jan 28, 2014

Shinsuke Kawai (Sungkyunkwan U)
SUSY, Seesaw, CMB
Jan 29, 2014

Elena Sorokina (Lomonosov Moscow State U)
Non-Hydrogen Supernovae within Extended Envelopes: Light Curve Modeling and Parameter Dependences
Jan 30, 2014

Yukinobu Toda (Kavli IPMU)
Flops and S-duality conjecture
Jan 30, 2014

Hans Jockers (U Bonn)
Characteristic classes from 2d renormalized sigma-models
Jan 30, 2014

Jeong-Hyuck Park (Sogang U)
Stringy Differential Geometry and N=2 D=10 Supersymmetric Double Field Theory
Feb 04, 2014

Lorenzo Sorbo (U Massachusetts, Amherst)
Naturally inflating on steep potentials through electromagnetic dissipation
Feb 05, 2014

Jeong-Hyuck Park (Sogang U)
How many is different? Answer from the ideal Bose gas
Feb 06, 2014

Rusu Cristian Eduard (U Tokyo/NAOJ)
Subaru Telescope Adaptive Optics Observations of the SDSS Gravitationally Lensed Quasars
Feb 06, 2014

Hiroyuki Sekiya (ICRR)
Review of Dark Matter Search with Liquid Xe Detector and Recent Results from XMASS
Feb 07, 2014

Gary Shiu (UW Madison/HKUST)
Stuckelberg Portal into Dark Sectors
Feb 12, 2014

Teppei Okumura (Kavli IPMU)
Nonlinear velocity statistics and redshift-space distortions in peculiar velocity surveys
Feb 13, 2014

Miguel Angel Javaloyes (U Murcia, Spain)
Interplay between Randers metrics and the causal geometry of stationary spacetimes. Almost isometries
Feb 14, 2014

Michihisa Takeuchi (King's College London)
New physics searches with boosted tops
Feb 19, 2014

Devendra Sahu (Indian Institute of Astrophysics, Bangalore)
Supernova SN 2012dn: A spectroscopic clone to SN 2006gz
Feb 19, 2014

Kohta Murase (IAS)
High-Energy Neutrinos as New Cosmic Messengers
Feb 21, 2014

Jim Lattimer (Stony Brook U)
How Large is a Neutron Star?
Feb 24, 2014

Masazumi Honda (Harish-Chandra Research Institute)
Higgs branch localization of 3d N = 2 theories
Feb 25, 2014

Eduardo Rozo (SLAC)
Planck Cosmology, Galaxy Clusters, and Neutrino Masses: the View from the Optical
Feb 25, 2014

Valerie Domcke (SISSA)
Justice for supersymmetric hybrid inflation
Feb 26, 2014

Hiraku Abe (Waseda U)
Young diagrams and intersection numbers for toric manifolds associated with Weyl chambers
Feb 27, 2014

Emanuele Daddi (CEA-Saclay)
Evolution of the star formation and gas content in galaxies through cosmic time
Feb 27, 2014

Richard Driessnack Eager (Kavli IPMU)
The Gauged Linear Sigma Model and GIT
Feb 27, 2014

Brian Feldstein (U Oxford)
Hypercharged dark matter and a new approach to halo-independent direct detection analysis
Feb 28, 2014

Genki Oouchi (Kavli IPMU)
Lagrangian embedding of cubic 4-folds containing a plane
Mar 03, 2014

Koji Hashimoto (Osaka U/Riken)
A Landscape in Boundary String Field Theory
Mar 04, 2014

Baojiu Li (Durham U)
Cosmology with new gravitational degrees of freedom
Mar 05, 2014

Marcello Bernardara (Institut de Mathématiques de Toulouse)
Derived categories, noncommutative motives and commutative theorems
Mar 10, 2014

Shiraz Minwalla (Tata Institute)
The Fluid Gravity Correspondence
Mar 10, 2014

Shiraz Minwalla (Tata Institute)
Scattering in Large N Matter Chern Simons theories
Mar 11, 2014

Yoshinari Hayato (ICRR)
The latest results from the T2K experiment
Mar 11, 2014

Serguey Todorov Petcov (SISSA/INFN, Kavli IPMU)
Predictions for the Dirac CP Violation in the Lepton Sector
Mar 12, 2014

Jun Koda (Swinburne U Technology)
A large number of fast cosmological simulations for the revised WiggleZ BAO measurement
Mar 14, 2014

Jackson Wu (NCTS Hsinchu, Taiwan)
A Holographic Model of the Kondo Effect
Mar 18, 2014

Dilip Kumar Ghosh (Indian Association for the Cultivation of Science)
Implications of 98 GeV and 125 GeV Higgs scenario in non-decoupling SUSY
Mar 19, 2014

Kohei Kamada (EPFL)
Inflation driven by the SM Higgs field after BICEP result
Mar 24, 2014

Takeshi Ikeda (Okayama U Science)
Pfaffian sum formula for the symplectic Grassmannians
Mar 24, 2014

Jarah Evslin (IHEP, Beijing/IMP, Lanzhou)
The Leptonic CP Phase from T2(H)K and oscillations from μ^+ Decay at Rest
Mar 25, 2014

Taro Kimura (CEA Saclay/RIKEN)
FQH/CFT and q-CFT
Mar 25, 2014

Tatsuma Nishioka (IAS Princeton)
Supersymmetric Renyi Entropy
Mar 26, 2014

Jun Okumura (Kyoto U)
The Type~Ia supernovae rate with Subaru/XMM-Newton Deep Survey
Mar 27, 2014

Peter Goddard (Institute for Advanced Study)
Q&A Session with Professor Peter Goddard
Mar 27, 2014

9 Visitors

This list includes principal investigators and affiliate members

FY2013

Abe, Hiraku
Waseda U, Mathematics
2014/02/27

Abe, Makito
U Tsukuba, Astrophysics
2013/12/25–12/27

Abe, Tomohiro
KEK, Particle Theory
2013/07/16–/07/19

Agarwalla, Sanjib Kumar
Institute of Physics, High Energy Physics
2013/11/11–11/13

Agostino, Luca
U Paris 7, Neutrino Physics
2013/11/11–11/13

Akhlaghi, Mohammad
Tohoku U, Astronomy
2013/08/13–08/16

Alekseevsky, Dimitri
IITP RAS, Mathematics
2014/03/09–03/16

Ali-Akbari, Mohammad
IPM, String Theory
2013/09/22–09/27

Andersen, Joergen E
Aarhus U, Mathematics
2013/07/24

Andreopoulos, Costas
U Liverpool, Neutrino Physics
2014/01/27–01/28

Angulo, Raul
KIPAC
2013/07/21–08/01

Antoniadis, Ignatios
CERN, Particle Theory
2013/07/17

Aoki, Katsuki
Waseda U, Cosmology
2013/04/08–04/10

Aoyama, Shohei
Nagoya U
2013/07/24–07/25

Arai, Shino
Ochanomizu U, Astrophysics
2013/12/25–12/27

Arana Catania, Miguel
UAM, Theoretical Physics
2014/01/15–04/05

Argurio, Riccardo
ULB, String Theory
2013/09/23–09/29

Armoni, Adi
Swansea U, String Theory
2012/10/04–2013/08/28

Arnold, Peter
U Virginia, Particle Theory
2013/09/24–09/28

Asaba, Shinsuke
Nagoya U, Cosmology
2013/07/22–07/24, 12/25–12/27

Asada, Hideki
Hirosaki U, Cosmology
2013/09/30–10/03

Asaka, Takehiko
Niigata U, Particle Theory
2013/12/02–12/04

Asano, Katsuaki
U Tokyo, ICRR, Astrophysics
2013/12/25–12/27

Asano, Ryosuke
Nagoya U
2013/12/18–12/20, 2014/01/16–01/18

Bae, Hanwool
Seoul Natl U, Mathematics
2014/02/10–02/14

Barannikov, Serguei
Jussieu Mathematics Inst, Mathematics
2014/02/09–02/12

Baroncelli, Tommaso
U Melbourne
2013/09/13

Basak, Tathagata
Iowa State U, Mathematics
2013/06/02–07/03

Bay, Muhammed Fatih
ETH Zurich, Neutrino Physics
2014/01/27–01/28

Bazhanov, Vladimi
Australian National U, Mathematical Physics
2013/08/04–08/06

Beem, Christopher
Stony Brook U, String Theory
2013/08/17–09/06

Behroozi, Peter
Stanford U, Cosmology
2013/07/15–07/28

Belov, Konstantin
UCLA, High Energy Physics
2013/12/01–12/07

Berger, Bruce
Colorado State U, Neutrino Physics
2013/06/21–06/22, 2014/01/16–01/24

Bergevin, Marc
UC Davis, Neutrino Physics
2013/06/21–06/22, 2014/01/27–01/28

Berkman, Sophie
U British Columbia, High Energy Physics
2014/01/27–01/28

Berlind, Andreas
Vanderbilt U, Cosmology
2013/07/21–07/27

Bernardara, Marcello
Institut de Mathématiques de Toulouse, Mathematics
2014/03/03–03/16

Bernardeau, Francis
CEA-Saclay, Astronomy
2013/10/18–11/01

Bershady, Matthew
U Wisconsin, Madison, Astronomy
2013/05/18–05/24

Bettarini, Stefano
INFN
2013/09/13, 2014/02/04

Bhadra, Sampa
York U, Experimental Physics
2014/01/27–01/28, 03/06–03/09

Bianchi, Lorenzo
Humboldt U, String Theory
2013/08/25–09/13

Bianchi, Marco Stefano
Humboldt U, String Theory
2013/08/24–09/22

Bishai, Mary
BNL, Experimental Physics
2013/11/11–11/13

Blanton, Michael R.
New York U, Astronomy
2013/05/19–05/24

Blinnikov, Sergei
ITEP, Astronomy
2013/05/13

Bodzenta-Skibinska, Agnieszka Maria
U Warsaw, Mathematics
2013/07/30–08/10, 2014/01/23–02/09

Bosch, Jim
Princeton U, Astrophysics
2013/09/02–09/07

Bosi, Filippo
INFN
2013/09/13

Bouchet, Francois R.
IAP, Astrophysics
2013/06/07

Bravar, Alessandro
U Geneva, Neutrino Physics
2013/06/21–06/22, 2014/03/06–03/09

Brodsky, Stanley J.
SLAC, Particle Theory
2013/09/23–09/29

Bronner, Christophe
Kyoto U, High Energy Physics
2013/06/21–06/22, 11/11–11/13, 2014/01/27–01/28, 03/06–03/09

Browder, Tom
U Hawaii, High Energy Physics
2013/11/18, 12/11

Brown, Jeffrey Steven
IBS, POSTECH, Mathematics
2014/02/09–02/15

Bruenner, Frederic
TU Vienna, String Theory
2013/09/22–09/28

Buchel, Alex
U Western Ontario, String Theory
2013/08/26–09/06

Buchholz, Detlev
Goettingen U, Field Theory
2014/03/09–03/21

Buchsteiner, Florian
HEPHY, Austrian Academy of Sciences, High Energy Physics
2013/09/13, 2014/02/04

Bunker, Andrew
U Oxford, Astrophysics
2013/03/31–04/13, 2014/01/06–01/15

Burrows, Adam
Princeton U, Astrophysics
2013/10/19–10/26

Bychkov, Boris
Higher School of Economics, National Research U, Mathematics
2014/02/09–02/15

Byler, Eleanor
U Washington, Astronomy
2013/06/18–08/19

Cacciato, Marcello
Leiden U, Cosmology
2013/07/21–2013/08/02

Caldwell, Robert
Dartmouth College, Cosmology
2013/04/06–04/12

Calland, Richard
U Liverpool, Neutrino Physics
2013/06/21–06/22, 2014/01/27–01/28

Callebaut, Nele
Ghent U, String Theory
2013/09/23–09/29

Calviani, Marco
CERN, Experimental Physics
2013/11/11–11/13

Cano Diaz, Mariana
UNAM, Astronomy
2013/05/19–05/25

Cao, Jun
Chinese Academy of Sciences, Experimental Physics
2013/11/11–11/13

Caponio, Erasm
TUoB, Mathematics
2013/09/29–10/03

Caravaca Rodriguez, Javier
IFAE-Barcelona
2013/06/21–06/22

Carminati, Giada
UC Irvine, Experimental Physics
2013/11/11–11/13, 2014/01/27–01/28

Carpi, Sebastiano
UNICH, Mathematics
2014/03/08–03/16

Carqueville, Nils
SCGP, Mathematical Physics
2013/07/14–07/30

Carr, Bernard
QMUL, Cosmology
2013/08/07

Casalderrey Solana, Jorge
U Barcelona, High Energy Physics
2013/09/23–09/29

Chakraborti, Manimala
Indian Association for the Cultivation of Science, Particle Theory
2013/07/15–2013/07/20

Chakraborty, Amit
Indian Association for the Cultivation of Science, Particle Theory
2013/07/15–07/27

Chan, Kwokwai
CUHK, Mathematics
2013/07/06–07/13, 2014/02/09–02/14

Chang, Chun-peng
Natl Tsing Hua U, Particle Theory
2013/07/15–07/20

Chang, Huai-Liang
HKUST, Mathematics
2014/02/09–02/16

Chen, Heng-Yu
Natl Taiwan U, String Theory
2013/08/25–09/01, 2014/03/09–03/18

Chen, Tai-jun
U Cambridge, Cosmology
2014/01/14–01/18

Chendvankar, Sanjay Rajaram
Tata Inst, High Energy Physics
2013/05/13–05/22, 09/16–10/05

Cheng, Yfang
National Central U, Particle Theory
2013/07/15–07/20

Cherdack, Daniel
Colorado State U, High Energy Physics
2013/11/11–11/13

Cherinka, Brian
U Toronto, Astronomy
2013/05/19–05/26

Chesler, Paul M.
MIT, Gravity
2013/09/23–09/29

Chiaki, Gen
U Tokyo, Astrophysics
2013/12/25–12/27

Chiba, Takeshi
Nihon U, Cosmology
2013/12/25–12/27

Chinone, Yuji
KEK, Astronomy
2013/04/02, 09/12–09/13

Chluba, Jens
Johns Hopkins U, Astronomy
2013/10/03–10/08

Cho, Cheol Hyun
Seoul Natl U, Mathematics
2014/02/09–02/15

Choi, Jun Ho
Dongshin U, Neutrino Physics
2014/01/27–01/28

Choi, Koun
Nagoya U, Neutrino Physics
2013/06/21–06/22

Chon, Sunmyon
U Tokyo, Astrophysics
2013/12/25 –12/27

Choudhury, Arghya
IISER, Particle Theory
2013/07/15–07/20

Christlieb, Norbert
U Heidelberg, Astronomy
2013/11/22

Chu, Jason
U Hawaii, Astronomy
2013/05/11–05/18

Chu, Zhe
Chinese Academy of Sciences, Astronomy
2013/09/30–10/03

Chuang, Wu-yen
Natl Taiwan U
2014/02/10–02/14

Cohn, Joanne
UC Berkeley, Cosmology
2013/07/13–07/28

Connoll, Kevin T
U Washington, Experimental Physics
2013/11/11–11/13, 12/27–2014/04/30

Cortes, Vincente
U Hamburg, Mathematics
2014/03/09–03/16

Costa, Miguel Sousa
U Porto, String Theory
2013/06/16–09/15

Coupon, Jean
ASIAA, Astronomy
2013/03/24–04/01

Craig, Nathaniel
Rurgers U, Piscataway, Particle Theory
2013/10/04–10/07

Cremonesi, Linda
QMUL, Neutrino Physics
2014/01/27–01/28

Creutzig, Thomas
TU Darmstadt, Mathematics
2013/03/31– 04/14

Daddi, Emanueledi
CEA–Saclay, Astronomy
2014/02/24–02/27

Davis, Marc
UC Berkeley, Astronomy
2013/09/02–2013/10/14

de Perio, Patrick
U Toronto, Neutrino Physics
2013/06/21–06/22, 11/11–11/13

Dealtry, Thomas
U Oxford, Neutrino Physics
2014/01/27–01/28

Decowski, Patrick
U Amsterdam/GRAPPA, Neutrino Physics
2013/11/04–11/13, 2014/03/19–03/22

Deffayet, Cedric
U Paris 7, Cosmology
2013/04/07–04/19

Degtyarev, Denis
Higher School of Economics, National Research U, Mathematics
2014/02/09–02/15

Deguchi, Shinsuke
Kumamoto U, Astrophysics
2013/12/25–12/27

Dewhurst, Debra
U Oxford, Neutrino Physics
2014/01/27–01/28

Di Lodovico, Francesca
QMUL, High Energy Physics
2013/06/21–06/22, 11/11–11/13,
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di Luise, Silvestro
ETH Zurich, Neutrino Physics
2014/01/27–01/28

Diemer, Colin
U Miami, Mathematics
2014/02/09–02/16

Djuric, Marko
U Porto, String Theory
2013/08/07–09/29

Domcke, Valerie Fiona
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2014/02/15–03/17

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U Texas, Astronomy
2013/05/19–05/25

Duffy, Kirsty
U Oxford, Neutrino Physics
2014/01/27–01/28

Dutton, Aaron
MPI for Astronomy, Astronomy
2013/04/08–04/14

Ebrahim Najafabadi, Hajar
IPM, String Theory
2013/09/22–09/27

Eda, Kazunari
U Tokyo, RESCEU, Astrophysics
2013/12/25–12/27

Efremenko, Yuri
U Tennessee, Neutrino Physics
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Eguchi, Tohru
Rikkyo U, Field Theory
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Ekelof, Tord
Uppsala U, Experimental Physics
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Ellis, John
CERN, Particle Theory
2013/06/05–06/07

Ellis, Richard
Caltech, Astronomy
2014/01/26–01/29

Enoki, Motohiro
Tokyo Keizai U, Astrophysics
2013/12/25–12/27

Enomoto, Sanshiro
U Washington, Neutrino Physics
2013/09/23–10/01, 2014/01/25–02/05

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Stony Brook U, Particle Theory
2013/11/15

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U Minnesota, Particle Theory
2013/11/03–11/16

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2013/07/16–07/19

Fan, Huijun
Peking U, Mathematics
2014/02/09–02/16

Farris, David
NCBS, Mathematics
2013/07/03–07/04

Favero, David Rudy
U Vienna, Mathematics
2014/02/12–02/14

Feldstein, Brian Stephen
U Oxford, Particle Theory
2014/02/24–02/28

Ferré-Mateu, Anna
NAOJ, Hawaii
2014/01/27

Ferro, Livia
Humboldt U, String Theory
2013/08/25–09/16

Festuccia, Guido
U Copenhagen, Particle Theory
2014/03/09–03/16

Feusels, Tom
U British Columbia, Neutrino Physics
2014/01/27–01/28

Fiorentini, Arturo
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2014/01/27–01/28, 03/06–03/09

Fokken, Jan
Humboldt U, String Theory
2013/08/25–09/07

Forti, Francesco
INFN
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Frebel, Anna
MIT, Astrophysics
2013/11/22

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2013/05/14–05/15, 09/13

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2013/11/11–11/13, 2014/01/27–01/28

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2013/06/29–07/02

Fujii, Yuri
Nagoya U, Astrophysics
2013/12/25–12/27

Fujikawa, Brian
LBL, Neutrino Physics
2013/11/24–12/13

Fujisawa, Kotaro
U Tokyo, Astrophysics
2013/12/25–12/27

Fujita, Yutaka
Osaka U, Astronomy
2013/12/25–12/27

Fukasawa, Shinya
Tokyo Metropolitan U, Particle Theory
2013/11/11–11/13

Fukaya, Kenji
SCGP, Mathematics
2014/02/09–02/16

Fukuda, Tsutomu
Toho U, Experimental Physics
2013/11/11–11/13

Fukuda, Yoshiyuki
Miyagi U of Education, High Energy Physics
2013/11/11–11/13

Fukui, Chihiro
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Furuya, Hitomi
U Tsukuba, Astrophysics
2013/12/25–12/27

Futaki, Masahiro
Kyoto U, Mathematics
2014/02/10–02/14

Futamase, Toshifumi
Tohoku U, Cosmology
2013/09/02–12/20

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2013/08/10–09/09

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2013/11/11–11/13

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2013/10/18

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2013/05/14–05/15

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2014/03/04–03/24

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2013/02/15–08/01

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CERN, High Energy Physics
2013/11/19–11/20

Giataganas, Dimitrios
U Patras, String Theory
2013/09/20–09/28

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2013/09/29–10/04

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2013/11/11–11/13

Giganti, Claudio
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2013/06/21–06/22

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2013/05/19–05/24

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2013/08/07–09/29

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2013/06/21–06/22, 2014/01/27–01/28

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U Aberdeen, Mathematics
2013/08/19–09/06

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Princeton U, Astronomy
2013/03/25–04/01, 08/27–08/29

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U Porto, String Theory
2013/08/13–09/15

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Boston U, Experimental Physics
2013/11/11–11/13

Haba, Junji
KEK, High Energy Physics
2013/08/05

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ANL, Cosmology
2013/07/21–07/28

Hachisu, Izumi
U Tokyo, Astronomy
2013/05/30, 12/25–12/27

Hadley, David
U Warwick, High Energy Physics
2013/06/21–06/22, 2014/01/27–01/28

Haegel, Leila
U Geneva, Neutrino Physics
2014/01/27–01/28

Haesler, Alexis
U Geneva, Neutrino Physics
2014/01/27–01/28

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U Tokyo, ICRR, Neutrino Physics
2013/11/11–11/13

Hagedorn, Claudia
U Padua, Cosmology
2013/07/05–07/10

Halverson, Nils
U Colorado, Boulder, Astronomy
2013/12/11

Hamaguchi, Koichi
U Tokyo, Particle Theory
2013/07/17–07/19

Hamanaka, Masashi
Nagoya U
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Hanabata, Yoshitaka
U Tokyo, ICRR, Astrophysics
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Hara, Koji
KEK, Particle Theory
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Harada, Akira
U Tokyo, Astrophysics
2013/12/25–12/27

Hasegawa, Chika
Rikkyo U, Particle Theory
2014/03/10–03/20

Hasegawa, Kenji
U Tsukuba, Astrophysics
2013/12/25–12/27

Hasegawa, Masaya
KEK, High Energy Physics
2013/04/02

Hasegawa, Yukihiko
Osaka U, Astrophysics
2013/12/25–12/27

Hashimoto, Ichihiko
Kyoto U, Particle Theory
2013/12/25–12/27

Hashimoto, Koji
Osaka U, Particle Theory
2013/09/23–09/27, 2014/03/03–03/04

Hashimoto, Yoshitake
Tokyo City U, Mathematics
2014/03/31

Hassan, Fawad
Stockholm U, Cosmology
2013/04/08–04/10

Hatta, Yoshitaka
Kyoto U, Particle Theory
2013/09/24–09/27

Hayakawa, Taku
U Tokyo, ICRR, Particle Theory
2013/12/02–12/04

Hayano, Hitoshi
KEK, Particle Theory
2013/07/16–07/20

Hayasaki, Kimitake
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2013/04/11

Hayashida, Masaaki
U Tokyo, ICRR, Particle Theory
2013/10/23

Hayashinaka, Takahiro
U Tokyo, RESCEU, Astrophysics
2013/12/25–12/27

Hayashino, Tatsuya
Kyoto U, Experimental Physics
2013/11/11–11/13

Hayato, Yoshinari
U Tokyo, ICRR, Neutrino Physics
2013/06/21–06/22, 11/11–11/13, 2014/01/27–01/28

Hayatsu, Natsuki
U Tokyo, Astrophysics
2013/12/25–12/27

Hazumi, Masashi
KEK, High Energy Physics
2013/12/25–12/27

He, BingRan
Nagoya U, Particle Theory
2013/09/23–09/28

Hearin, Andrew
Fermilab, Cosmology
2014/03/30–04/12

Hearty, Fred
U Virginia, Astronomy
2013/05/19–05/24

Heeger, Karsten
Yale U, Neutrino Physics
2013/11/11–11/13

Heinz, Ulrich
Ohio State U, Nuclear Physics
2013/12/13–12/14

Heinze, Martin
Humboldt U, String Theory
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Heitmann, Katrin
ANL, Cosmology
2013/07/21–07/28

Heller, Michal P.
U Amsterdam, String Theory
2013/09/22–09/29

Helmer, Richard
TRIUMF, Neutrino Physics
2014/01/27–01/28

Henning, Brian
UC Berkeley, Particle Theory
2013/09/13–12/09

Higuchi, Yuichi
U Tokyo, Astronomy
2013/12/25–12/27

Hikage, Chiaki
Nagoya U, KMI, Astronomy
2013/07/22–07/26

Hill, Gary
U Texas, Cosmology
2013/05/19–05/24

Hill, Jim
California State U, High Energy Physics
2013/11/11–11/13

Hillier, Robin
Lancaster U, Mathematics
2014/03/09–03/21

Himemoto, Yoshiaki
Nihon U, Astrophysics
2013/12/25–12/27

Himmel, Alexander I.
Duke U, High Energy Physics
2014/01/27–01/28

Hirai, Yutaka
U Tokyo, Astronomy
2013/12/25–12/27

Hirano, Kouichi
Tsuru U, Cosmology
2013/12/25–12/27

Hirano, Shingo
U Tokyo, Astronomy
2013/12/25–12/27

Hirota, Seiko
Kyoto U, Neutrino Physics
2013/06/21–06/22, 2014/01/27–01/28

Hisano, Junji
Nagoya U, Particle Theory
2013/11/11–11/13

Hoare, Ben
Humboldt U, String Theory
2013/08/25–09/13

Hoeche, Stefan
SLAC, Particle Theory
2013/05/29–05/30

Holder, Gilbert
McGill U, Astrophysics
2013/10/09–10/11

Hollands, Stefan
Leipzig U, Mathematics
2014/03/09–03/23

Honda, Daigo
U Tokyo, Particle Theory
2013/08/26–09/06

Honda, Masazumi
Harish-Chandra Research Institute, Particle Theory
2014/02/25, 03/09–03/21

Hong, Deog-Ki
Pusan National U, Particle Theory
2013/09/23–09/29

Hong, Hansol
Seoul National U, Mathematics
2014/02/09–02/15

Horiuchi, Shinji
CDSCC, Astronomy
2013/12/25–12/27

Horiuchi, Shunsaku
UC Irvine, Astroparticle Physics
2013/11/11–11/13, 12/10

Hoshino, Hanako
Nagoya U, Cosmology
2013/08/08–08/09, 08/28–08/29, 10/21–11/01, 11/27–12/03, 2014/02/01–02/18, 02/25–03/03

Hoshino, Hironori
Nagoya U, Nuclear Physics
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Hosokawa, Takashi
U Tokyo, Astrophysics
2013/12/25–12/27, 2014/01/15

Hosomichi, Kazuo
Kyoto U, Particle Theory
2014/03/09–03/20

Hosoya, Akio
Tokyo Tech, Particle Theory
2013/12/25–12/27

Hotokezaka, Kenta
Kyoto U, Astrophysics
2013/12/25–12/27

Hotta, Hideyuki
U Tokyo, Astronomy
2013/12/25–12/27

Houri, Tsuyoshi
Rikkyo U, Cosmology
2013/06/20

Hozumi, Shunsuke
Shiga U, Astronomy
2013/12/25–12/27

Hua, Zheng
CUHK, Mathematics
2013/06/20–07/20

Huang, Kunxian
Kyoto U, Neutrino Physics
2013/06/21–06/22, 2014/01/27–01/28

Huang, Weicong
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2013/07/15–07/20

Huang, Xiaoyuan
Chinese Academy of Sciences, Astronomy
2013/04/08–04/12

Hubeny, Veronica
Durham U, String Theory
2013/09/23–09/29

Hwang, DongSeon
Ajou U, Mathematics
2013/07/23–08/06

Hwang, Narae
NAOJ, Astronomy
2013/12/10–12/11

Hwang, Taekgyu
KIAS, Mathematics
2014/02/10–02/14

Ichimasa, Ryotaro
Kyushu U, Astrophysics
2013/12/25–12/27

Igarashi, Asuka
U Tsukuba, Astrophysics
2013/12/25–12/27

Igarashi, Takafumi
Nagoya U, Particle Theory
2013/07/16–07/20

Iijima, Toru
Nagoya U, KMI, High Energy Physics
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Ikeda, Hiroyuki
Ehime U, Astronomy
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Ikeda, Motoyasu
Kyoto U, High Energy Physics
2013/06/14–06/15, 2014/01/27–01/28

Imada, Mitsuhiro
Keio U, Mathematics
2014/02/10–02/14

Imamura, Yosuke
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2014/03/09–03/20

Imber, James
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2013/11/11–11/13

Inagaki, Takahiro
Nagoya U, Cosmology
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Inami, Takeo
Chuo U, Field Theory
2013/04/08–04/10, 2014/02/03

Inayoshi, Kohei
Kyoto U, Astrophysics
2013/12/25–12/27

Inoue, Tsuyoshi
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2013/12/25–12/27

Inoue, Yoshiyuki
KIPAC, Astrophysics
2013/10/31–11/01

Inutsuka, Shu-ichiro
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2013/12/25–12/27

Ioka, Kunihito
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2013/12/25–12/27

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2014/02/10–02/15

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2013/08/30–09/06, 2014/02/10–02/14

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2013/05/14–05/15, 09/13, 2014/02/04

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2013/11/11–11/13

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Ishida, Hiroyuki
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2013/12/02–12/04

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2013/06/21–06/22, 11/11–11/13, 2014/01/27–01/28, 03/06–03/09

Ishidoshiro, Koji
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Ishikawa, Kazuya
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2013/07/16–07/19, 12/02–12/04

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2013/11/11–11/13

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Kyoto U, Astronomy
2013/12/25–12/27

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2014/02/09–02/19

Iso, Satoshi
KEK, Particle Theory
2013/10/09

Isoyama, Soichiro
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2013/12/25–12/27

Ito, Ayaka
Hosei U, Astrophysics
2013/12/25–12/27

Ito, Hirotaka
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2013/09/24–09/27, 2014/03/10–03/20

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2013/12/25–12/27

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2013/06/21–06/22, 11/11–11/13

Iwamoto, Nobuyuki
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Iwasaki, Kazunari
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2013/12/25–12/27

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2013/04/21–04/23, 08/06–08/07, 09/13, 09/24–09/27

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2013/10/07

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2013/11/11–11/13

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2013/12/25–12/27

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2014/01/27–01/28

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2013/09/21–09/29

Jarvinen, Matti
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Jarvis, Tyler J.
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2013/07/15–07/29

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2013/11/02–11/09

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2014/01/27–02/26

Joo, Kyung Kwang
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2013/11/11–11/13

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2013/12/25–12/27

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2014/03/10–03/20

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2013/12/25–12/27

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2013/09/24

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Kant, Philipp
Humboldt U, Particle Theory
2013/12/01–12/04

Kapranov, Mikhail
Yale U, Mathematics
2013/08/11–08/24

Karasawa, Shintaro
Kyoto U, Nuclear Physics
2013/09/24–09/27

Karino, Shigeyuki
Kyushu Sangyo U, Astronomy
2013/12/25–12/27

Kasai, Masumi
Hirosaki U, Cosmology
2013/09/30–10/03

Kashikawa, Nobunari
NAOJ, Astronomy
2013/12/25–12/27

Kashino, Daichi
Nagoya U, Astronomy
2013/05/07–05/17, 07/10–07/26, 2014/02/24–02/28

Kasuya, Shinta
Kanagawa U, Particle Theory
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Kataoka, Akimasa
Sokendai, Astronomy
2013/12/25–12/27

Kato, Eriko
Tohoku U, High Energy Physics
2013/07/15–07/20

Kato, Kazuki
U Tsukuba, Astrophysics
2013/12/25–12/27

Kato, Mariko
Keio U, Astrophysics
2013/12/25–12/27

Kato, Tsunehiko
Hiroshima U, Astrophysics
2013/12/25–12/27

Katori, Teppei
MIT, Neutrino Physics
2014/01/27–01/28

Katsanevas, Stavros
IN2P3/CNRS, Astroparticle Physics
2013/11/10–11/16

Katsuda, Satoru
RIKEN
2013/07/18, 08/21

Kawabata, Sayaka
Tohoku U, Particle Theory
2013/07/15–07/20

Kawaguchi, Kyohei
Kyoto U, Astrophysics
2013/12/25–12/27

Kawaguchi, Toshihiro
Yamaguchi U, Atrophysics
2013/12/25–12/27

Kawai, Nobuyuki
Tokyo Tech, Astroparticle Physics
2013/12/25–12/27

Kawai, Shinsuke
Sungkyunkwan U, String Theory
2014/01/29

Kawakatsu, Nozomu
Kure National College of Technology, Astrophysics
2013/12/25–12/27

Kawamura, Yoshiharu
Shinshu U, Particle Theory
2013/11/05–11/06

Kawanaka, Norita
U Tokyo, Astrophysics
2013/12/25–12/27

Kawasaki, Morimichi
U Tokyo, Mathematics
2013/06/11, 2014/02/10–02/14

Kawashima, Tomohisa
SHAO, Astronomy
2013/12/25–12/27

Kayano, Tsubasa
Okayama U
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Kayo, Issha
Toho U, Astrophysics
2013/04/18, 04/30, 05/14, 06/13, 09/18, 12/10, 12/18, 12/25–12/27

Kearns, Edward
Boston U, Neutrino Physics
2013/10/15–10/24, 11/11–11/13, 2014/01/27–01/28

Ketov, Sergey
Tokyo Metropolitan U, Cosmology
2013/04/08–04/10, 12/02–12/04

Kewley, Lisa
Australian National U, Astronomy
2013/05/15–05/18

Khabibullin, Marat
INR, RAS, High Energy Physics
2013/06/21–06/22, 2014/01/27–01/28

Khabibulline, Emil
CALTECH, Astronomy
2013/06/16–08/31

Kiguchi, Masayoshi
Kinki U, Astrophysics
2013/12/25–12/27

Kiko, Masashi
Waseda U, Astrophysics
2013/04/08–04/10

Kim, Bom Soo
Tel Aviv U, String Theory
2013/07/07–07/20

Kim, Bumsig
KIAS, Mathematics
2013/10/27–11/08, 2014/02/09–02/12

Kim, Heeyeon
Seoul National U, String Theory
2013/12/01–12/12

Kim, Jae Yool
Chonnam National U, High Energy Physics
2013/06/21–06/22, 2014/01/27–01/28

Kim, Jiae
U British Columbia, Neutrino Physics
2014/01/27–01/28

Kim, Jinsu
Sungkyunkwan U, Particle Theory
2013/07/15–07/20

Kim, Jongkuk
Sungkyunkwan U, Particle Theory
2013/07/15–07/20

Kim, Soo-Bong
Seoul National U, Experimental Physics
2013/11/11–11/13

Kimura, Rampei
U Tokyo, RESCEU, Astrophysics
2013/04/08–04/10, 10/29, 12/25–12/27

Kimura, Shigeo
Osaka U, Astrophysics
2013/12/25–12/27

Kimura, Taro
U Tokyo, Condensed Matter Physics
2014/03/25

Kinugawa, Tomoya
Kyoto U, Astrophysics
2013/12/25–12/27

Kirihara, Takanobu
U Tsukuba, Astrophysics
2013/12/25–12/27

Kirillov, Anatol N.
Kyoto U, Mathematics
2013/08/13–08/30

Kiritsis, Elias
U Paris 7, Cosmology
2013/09/24–09/29

Kisaka, Shota
U Tokyo, ICRR, Astrophysics
2013/12/25–12/27

Kitahara, Teppei
U Tokyo, Particle Theory
2013/12/02–12/04

Kitajima, Naoya
U Tokyo, ICRR, Astrophysics
2013/12/25–12/27

Kitamura, Tomotaka
Waseda U, Cosmology
2013/04/08–04/10

Kitano, Ryuichiro
KEK, Particle Theory
2013/05/22

Kitayama, Tetsu
Toho U
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Kitazawa, Yoshihisa
KEK, Particle Theory
2014/03/31

Kiuchi, Kenta
Kyoto U, Astrophysics
2013/12/25–12/27

Knapp, Johanna
TU Vienna, String Theory
2013/11/16–11/26

Ko, Pyungwon
KIAS, High Energy Physics
2013/11/30–12/07, 2014/03/08–03/14

Kobayashi, Chiaki
CAR, U of Hertfordshire, Astronomy
2013/03/30–04/14, 12/27–2014/01/19

Kobayashi, Daiki
Nagoya U, Particle Theory
2013/11/11–11/13

Kobayashi, Masakazu
Ehime U, Astronomy
2013/12/25–12/27

Kobayashi, Masato
Nagoya U, Astrophysics
2013/11/12–2013/11/15, 11/26–12/27, 2014/02/17–02/28

Kobayashi, Takashi
KEK, High Energy Physics
2013/11/11–11/13

Kobayashi, Tsutomu
Rikkyo U, Cosmology
2013/04/08–04/09

Koda, Jun
Swinburne U, Astronomy
2014/03/10–03/14

Kodali, Kameswara Rao
Tata Inst, High Energy Physics
2013/09/16–10/12, 11/25–12/21, 2014/02/01–03/15

Koga, Taichiro
U Tokyo, Experimental Physics
2013/11/11–11/13

Kohri, Kazunori
KEK, Cosmology
2013/12/25–12/27

Kojima, Sadayoshi
Tokyo Tech, Mathematics
2013/06/06

Kolwalkar, Mangesh Madhukar
Tata Inst
2014/02/13–03/23

Komatsu, Eiichiro
MPI for Astrophysics, Cosmology
2013/11/17–11/19

Komatsu, Shota
U Tokyo, Particle Theory
2013/08/26–09/06

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U Tsukuba, Astrophysics
2013/12/25–12/27

Komiya, Yutaka
NAOJ, Astronomy
2013/12/25–12/27

Konaka, Akira
TRIUMF, Neutrino Physics
2013/06/21–06/22, 2014/01/27–01/28, 03/06–03/09

Konishi, Yukiko
Kyoto U, Mathematics
2014/01/27, 02/10–02/14

Korpas, Georgios
Instituto de Fisica Teorica, String Theory
2013/09/23–09/28

Koshio, Yusuke
Okayama U, Neutrino Physics
2013/06/21–06/22, 11/11–11/13, 2014/01/13–01/15, 01/27–01/28

Kosower, David
CEA-Saclay, Particle Theory
2013/08/28–09/03

Kostov, Ivan
IPhT, CEA-Saclay, String Theory
2013/08/28–10/20

Kouchner, Antoine
U Paris 7, Neutrino Physics
2013/11/11–11/13

Koyama, Yoji
Chuo U, Cosmology
2013/04/08–04/10

Koyama, Kazuya
U Portsmouth, Cosmology
2013/07/21–07/26

Kropp, William
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2013/11/11–11/13

Kubo, Jisuke
Kanazawa U, Particle Theory
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Kubota, Hirohisa
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2013/07/16–07/20

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U Tokyo, RESCEU, Astrophysics
2013/12/25–12/27

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2013/09/22–09/29

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U Tokyo, Astrophysics
2013/12/25–12/27

Kusano, Kanya
Nagoya U, Astrophysics
2013/12/25–12/27

Kusenko, Alexander
UCLA, Particle Theory
2013/10/11–12/10

Kutasov, David
U Chicago, Particle Theory
2013/09/24–09/28

Kuwahara, Takumi
Nagoya U, Particle Theory
2013/11/11–11/13

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2013/06/21–06/22, 11/11–11/13, 2014/01/27–01/28

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2013/07/21–07/26

Labarga, Luis
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2013/06/21–06/22, 11/11–11/13

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Nationall Taiwan U, High Energy Physics
2013/10/03–10/05

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2014/02/09–02/22

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2014/03/21–03/26

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U Toronto, Astrophysics
2013/05/18–05/26

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KIAS, Mathematics
2013/07/28–08/06

Lee, Jae Hyouk
Ewha Womans U, Mathematics
2013/07/31–08/06

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IBS, POSTECH, Mathematics
2014/02/10–02/14

Lee, SeungHak
Sungkyunkwan U, Particle Theory
2013/07/15–07/20

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KIAS, String Theory
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Leitner, Rupert
Charles U, Prague, Experimental Physics
2013/11/11–11/13

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LBL, Neutrino Physics
2013/11/11–11/13

Lho, Hyenho
Seoul National U, Mathematics
2014/02/09–02/14

Li, Baojiu
Durham U, Cosmology
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Li, Qin
CUHK, Mathematical Physics
2014/02/09–02/14

Li, Si
Boston U, Mathematics
2013/06/29–07/25, 2014/02/09–02/15

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MPI for Gravitational Physics, String Theory
2014/01/14–01/19

Li, Weiping
HKUST, Mathematics
2014/02/09–02/16

Li, Yin
KICP, Cosmology
2014/01/10–01/18

Liew, Seng Pei
U Tokyo, Particle Theory
2013/07/15–07/20

Lim, In Taek
Chonnam National U, High Energy Physics
2013/06/21–06/22

Limongi, Marco
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2013/04/15–04/28, 11/03–11/05

Lin, Chia-Min
Chuo U, Cosmology
2013/04/08–04/10

Lin, Yen-Ting
ASIAA, Astrophysics
2013/05/22–05/25, 08/29

Lindner, Manfred
MPI for Nuclear Physics, Neutrino Physics
2013/11/11–11/13

Lindner, Thomas
TRIUMF, Neutrino Physics
2014/01/27–01/28

Lisi, Eligio
INFN Bari, Neutrino Physics
2013/11/11–11/13

Liu, Da
Chinese Academy of Sciences, Particle Theory
2013/07/15–07/20

Liu, Jia
Columbia U, High Energy Physics
2013/06/21–06/22

Liu, Wanmin
HKUST, Mathematics
2013/10/20–10/26

Loganayagam, Ramalingam
Harvard U, High Energy Physics
2013/09/24–09/28

Logvinenko, Timothy
U Warwick, Mathematics
2013/11/11–11/27

Losev, Andrey
Higher School of Economics, National Research U, Mathematics
2014/02/10–02/16

Lukowski, Tomasz
Humboldt U, String Theory
2013/08/24–09/22

Ma, Kai
KEK, Particle Theory
2013/07/15–07/20

Ma, Ziming Nikolas
CUHK, Mathematics
2013/05/19–05/25

MacDonald, Nicholas
U Washington, Astronomy
2013/05/18–05/25

Maeda, Hideki
Rikkyo U, Cosmology
2013/07/16

Maeda, Junpei
Tokyo Metropolitan U, Experimental Physics
2013/11/11–11/13

Maeda, Kei-ichi
Waseda U, Cosmology
2013/04/08–04/10, 10/01–10/03

Makiya, Ryu
U Tokyo, IoA, Astronomy
2013/12/25–12/27

Malek, Matthew
Imperial College London, Neutrino Physics
2014/01/27–01/28

Malkan, Matthew
UCLA, Astronomy
2013/07/07–07/09

Manabe, Masahide
Nagoya U, String Theory
2014/03/07–03/15

Manecki, Szymon
Virginia Tech, High Energy Physics
2013/06/21–06/22

Marchesini Danilo
Tufts U, Astronomy
2013/11/24–12/07

Marchionni, Alberto
Fermilab, Experimental Physics
2013/11/11–11/13

Mariani, Camillo
Virginia Tech, High Energy Physics
2013/06/21–06/22, 2014/01/27–01/28

Marks, Christopher
Alberta U, Mathematics
2013/11/18–11/24

Marrone, Antonio
U. Bari, Neutrino Physics
2013/11/11–11/13

Martelli, Dario
King's College London, Theoretical Physics
2014/03/10–03/18

Martin, John
U Toronto, Experimental Physics
2014/01/27–01/28

Martin, John
U Toronto, Experimental Physics
2014/03/06–03/09

Maruyama, Takasumi
KEK, High Energy Physics
2013/11/11–11/13

Maruyoshi, Kazunobu
Caltech, Theoretical Physics
2013/09/01–09/10, 2014/03/13–03/21

Mas Sole, Javier
U Santiago de Compostela, String Theory
2013/08/18–09/07

Masters, Karen L.
U Portsmouth, Astronomy
2013/05/19–05/26

Masuda, Kento
U Tokyo, Astrophysics
2013/12/25–12/27

Matsubara, Takahiko
Nagoya U, KMI, Cosmology
2013/12/25–12/27

Matsubara, Tsunayuki
Tokyo Metropolitan U, Neutrino Physics
2014/01/27–01/28

Matsuhara, Hideo
JAXA, Astronomy
2013/12/25–12/27

Matsui, Chihiro
U Tokyo, IIS, Particle Theory
2013/08/27–08/28

Matsui, Hiroki
KEK, Particle Theory
2013/07/15–07/19

Matsui, Taku
Kyushu U, Mathematical Physics
2014/03/10–03/20

Matsumoto, Kazuko
Tokyo U of Science, Mathematics
2014/02/10–02/14

Matsumoto, Tatsuya
Kyoto U, Astrophysics
2013/12/25–12/27

Matsumura, Tomotake
KEK, Cosmology
2013/04/02, 04/12

Matsuno, Hiroki
Tokyo Tech, Particle Theory
2014/03/10–03/20

Matsuno, Shigenobu
U Hawaii, High Energy Physics
2013/06/21–06/22

Matsuura, Shunji
McGill U, String Theory
2013/04/15–04/16

Mauger, Christopher
LANL, Neutrino Physics
2013/06/21–06/22

Mawatari, Kentaro
Vrije Universiteit Brussel, Particle Theory
2013/07/15–07/27

Maydanskiy, Makism
Stanford U, Mathematics
2013/07/16–07/30

Mayekar, Sukant Narendra
Tata Inst, High Energy Physics
2013/09/16–09/28, 11/25–12/21, 2014/02/20–03/20

Mazzanti, Liuba
Utrecht U, String Theory
2013/09/23–09/29

McCauley, Neil
U Liverpool, High Energy Physics
2014/01/27–01/28

McDermid, Richard
Gemini Observatory, Astronomy
2013/05/19–05/24

Menard, Brice
Johns Hopkins U, Astrophysics
2013/08/12–09/03

Miki, Yohei
U Tsukuba, Astrophysics
2013/12/25–12/27

Minakata, Hisakazu
Instituto de Física, Neutrino Physics
2014/01/27–01/28

Minamino, Akihiro
Kyoto U, Neutrino Physics
2013/06/21–06/22, 11/11–11/13, 2014/01/27–01/28

Minasian, Ruben
IPhT, CEA-Saclay, String Theory
2013/08/27–09/06

Mine, Shunichi
UC Irvine, Neutrino Physics
2013/06/21–06/22, 11/11–11/13, 2014/01/27–01/28

Mineshige, Shin
Kyoto U, Astrophysics
2013/12/25–12/27

Minwalla, Shiraz
Tata Inst, String Theory
2014/03/09–03/11

Mitev, Vladimir
Humboldt U, String Theory
2013/08/25–09/21

Miura, Makoto
U Tokyo, ICRR, High Energy Physics
2013/06/21–06/22, 11/11–11/13, 2014/01/27–01/28,

Miura, Makoto
U Tokyo, Mathematics
2014/01/28

Miyabayashi, Kenkichi
Nara Women's U, High Energy Physics
2013/10/10–10/11

Miyahara, Hiroko
Musashino Art U, Cosmology
2013/04/22

Miyajima, Kimio
Kagoshima U, Mathematics
2014/02/10–02/14

Miyamoto, Yuhei
U Tokyo, RESCEU, Cosmology
2013/12/25–12/27

Miyatake, Hironao
Princeton U, High Energy Physics
2013/05/09–05/17

Miyazaki, Satoshi
NAOJ, Astronomy
2013/12/25–12/27

Mizukami, Kuniyoshi
Yokohama National U
2013/06/17, 09/03, 10/11, 11/18–11/19, 12/10

Mizuta, Akira
RIKEN, Astrophysics
2013/12/25–12/27

Mizutani, Kohei
Saitama U, Astrophysics
2013/12/25–12/27

Mohanty, Gagan Bihari
Tata Inst, High Energy Physics
2013/10/22–11/07, 2014/02/01–02/15

Mori, Masaki
Ritsumeikan U, Astrophysics
2013/12/25–12/27

Mori, Masaki
U Tokyo, Mathematics
2013/07/02

Mori, Masao
U Tsukuba, Astrophysics
2013/12/25–12/27

Mori, Shingo
KEK, Particle Theory
2013/07/16–07/19

Mori, Shoji
Tokyo Tech, Astrophysics
2013/12/25–12/27

Morita, Takeshi
KEK, String Theory
2013/05/10

Moriya, Hajime
Shibaura Inst of Tech, Mathematical Physics
2014/03/10–03/20

Moriyama, Sanefumi
Nagoya U, String Theory
2013/10/29

Morrison, David R.
UC Santa Barbara, Mathematics
2013/06/05–06/09, 2014/01/13–01/14

Motegi, Kohei
Okayama Inst for Quantum Physics, Mathematics
2014/02/10–02/14

Mueller, Alfred
Columbia U, Particle Theory
2013/09/24–09/28

Mueller, Berndt
Duke U, Particle Theory
2013/12/09

Muether, Mathew
Fermilab, Experimental Physics
2013/11/11–11/13

Muramatsu, Yu
Nagoya U, Particle Theory
2013/11/11–11/13

Muranushi, Takayuki
Kyoto U, Astrophysics
2013/12/25–12/27

Murase, Kohta
IAS, Astrophysics
2013/12/25–12/27, 2014/02/20–02/22

Murphy, Sebastien
CERN, Experimental Physics
2013/11/11–11/13

Nagai, Daisuke
Yale U, Cosmology
2013/12/25–12/27

Nagai, Minoru
U Tokyo, High Energy Physics
2013/12/02–12/04

Nagai, Tomoya
U Tsukuba, Astrophysics
2013/12/25–12/27

Nagakura, Hiroki
Kyoto U, Astrophysics
2013/12/25–12/27

Nagamine, Kentaro
Osaka U, Astrophysics
2013/12/25–12/27

Naganawa, Naotaka
Nagoya U, Experimental Physics
2013/11/11–11/13

Nagao, Tohru
Kyoto U, Astronomy
2013/05/07–05/17

Nagasawa, Michiyasu
Kanagawa U, Cosmology
2013/12/25–12/27

Nagashima, Masahiro
Nagasaki U, Astrophysics
2013/12/25–12/27

Nagata, Natsumi
Nagoya U, Particle Theory
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Nagataki, Shigehiro
Kyoto U, Astrophysics
2013/12/25–12/27

Nakadaira, Takeshi
KEK, Experimental Physics
2013/11/11–11/13

Nakagawa, Takao
JAXA, Astrophysics
2013/06/18

Nakahata, Masayuki
U Tokyo, ICRR, Astroparticle Physics
2013/11/11–11/13, 2014/01/27–01/28

Nakajima, Takeo
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2013/06/21–06/22, 11/11–11/13

Nakamoto, Tatsushi
KEK, Particle Theory
2013/07/19

Nakamura, Fumitaka
NAOJ, Astronomy
2013/12/25–12/27

Nakamura, Junya
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2013/07/16–07/19

Nakamura, Katsuro
KEK, High Energy Physics
2013/05/23, 05/30, 06/07, 11/05, 2014/03/04, 03/20, 03/24

Nakamura, Keigo
Nagoya U, Experimental Physics
2013/11/11–11/13

Nakamura, Ko
Waseda U, Astronomy
2013/12/25–12/27

Nakamura, Shin
Nagoya U, Particle Theory
2013/04/01–04/03, 09/24–09/27

Nakamura, Yusuke
U Tokyo, Mathematics
2013/04/02

Nakanishi, Hiroyuki
Kagoshima U, Astronomy
2013/12/25–12/27

Nakano, Hiroyuki
Kyoto U, Astrophysics
2013/12/25–12/27

Nakano, Yuuki
U Tokyo, ICRR, Experimental Physics
2013/11/11–11/13

Nakasato, Naohito
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2013/05/30, 2014/03/05–03/06

Nakauchi, Daisuke
Kyoto U, Astrophysics
2013/12/25–12/27

Nakaya, Tsuyoshi
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2013/06/21–06/22, 11/11–11/13, 2014/01/27–01/28

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2013/06/21–06/22, 11/11–11/13, 2014/01/27–01/28, 03/06–03/09

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2013/11/11–11/13, 12/25–12/27

Namekata, Daisuke
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2013/12/25–12/27

Namikawa, Toshiya
Kyoto U, Astronomy
2014/01/28–01/30

Narikawa, Tatsuya
Osaka U, Astrophysics
2013/12/25–12/27

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2013/11/11–11/13

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2013/07/15–07/19

Nasuda, Tetsuya
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2013/12/25–12/27

Natarajan, Aravind
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2013/12/12–12/13

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2013/05/10, 06/17, 08/05, 09/03, 09/12–09/13, 10/11, 11/11, 11/18–11/19, 12/10, 2014/02/04

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2013/09/24–09/27

Neder, Thomas
U Southanpton, Neutrino Physics
2014/02/10–03/19

Niino, Yu
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2013/05/13–05/17, 12/25–12/27

Nilsson, Bengt
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2013/06/13–06/20

Nishimichi, Takahiro
IAP, Astronomy
2014/02/17–02/19

Nishimura, Nobuya
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2013/12/25–12/27

Nishimura, Takuya
U Tokyo, Particle Theory
2013/08/26–09/06

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2014/02/10–02/14

Nishioka, Tatsuma
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2014/03/24–03/29

Nitti, Francesco
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Nomura, Mariko
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2013/12/25–12/27

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Nozawa, Shinsaku
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2013/09/23–09/29

Ogiya, Go
U Tsukuba, Astrophysics
2013/12/25–12/27

Oh, Jeongseok
KAIST, Mathematics
2014/02/09–02/15

Oh, Yong-Geun
IBS, POSTECH, Mathematics
2014/02/09–02/13

Ohira, Yutaka
Aoyama Gakuin U, Astrophysics
2013/12/25–12/27

Ohno, Yoshiko
Ochanomizu U, Particle Theory
2013/04/08–04/10

Ohsuga, Ken
NAOJ, Astrophysics
2013/12/25–12/27

Ohta, Hiroshi
Nagoya U, Mathematics
2014/02/09–02/16

Ohta, Nobuyoshi
Kinki U, Particle Theory
2013/04/08–04/09

Oka, Akira
U Tokyo, Astrophysics
2013/07/22–07/26

Okada, So
Oyama National College of Technology, Mathematics
2014/02/10–02/14

Okajima, Yuji
Tokyo Tech, High Energy Physics
2013/06/21–06/22, 11/11–11/13, 2014/01/27–01/28

Okamura, Sadanori
Hosei U, Astronomy
2013/06/06, 12/25–12/27

Okawa, Masanori
Hiroshima U, String Theory
2013/05/20

Okumura, Jun
Kyoto U, Astrophysics
2014/03/27

Okumura, Kimihiro
U Tokyo, ICRR, Neutrino Physics
2013/06/21–06/22, 11/11–11/13, 2014/01/27–01/28, 03/06–03/09

Okumura, Teppei
IEU, Ewha Womans U, Cosmology
2013/12/01–12/03

Okura, Yuki
NAOJ, Astronomy
2013/12/25–12/27

Okuzumi, Satoshi
Tokyo Tech, Astrophysics
2013/12/25–12/27

Olivares, Felipe
U Andres Bello, Astronomy
2013/11/07–11/08

Omori, Kantaro
U Tokyo, Particle Theory
2013/05/15

Omukai, Kazuyuki
Tohoku U, Astrophysics
2013/12/25–12/27

Omura, Takuya
Nagoya U, Particle Theory
2013/11/11–11/13

Ono, Kaoru
Kyoto U, Mathematics
2014/02/09–02/16

Ono, Kenji
U Tokyo, ICRR, Astrophysics
2013/12/25–12/27

Onodera, Masato
CEA-Saclay, Astrophysics
2013/05/13–05/17

Onoma, Akitomo
U Tsukuba, Astrophysics
2013/12/25–12/27

Onuki, Yoshiyuki
U Tokyo, ICEPP, High Energy Physics
2013/04/09–04/11, 04/15–04/16, 04/18–04/19

Oogi, Taira
Nagasaki U, Astrophysics
2013/12/25–12/27

Ootsuka, Takayoshi
Ochanomizu U, Mathematical Physics
2013/09/30–10/03

Orii, Asato
U Tokyo, ICRR, Experimental Physics
2013/11/11–11/13

Orita, Ryuma
U Tokyo, Mathematics
2014/02/10–02/14

Orlando, Domenico
CERN, String Theory
2013/04/07–05/06

Orlando, Domenico
École normale supérieure, String Theory
2013/11/18–12/20

Otani, Yul
U Tokyo, Mathematics
2014/03/10–03/20

Oyama, Yuichi
KEK, Experimental Physics
2013/11/11–11/13, 2014/01/27–01/28

Pajitnov, Andrei
U Nantes, Mathematics
2013/04/07–06/23

Pando Zayas, Leopoldo A.
U Michigan, High Energy Physics
2013/09/23–09/29, 2014/03/10–03/21

Papayanov, Grigory
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2014/02/10–02/15

Park, Hwanbae
Kyungpook National U, High Energy Physics
2013/07/30–08/02

Park, Hyunbae
U Texas, Astrophysics
2013/06/18–08/19

Park, Jeong-Hyuck
Sogang U, String Theory
2014/02/03–02/07

Parrish, Ian
CITA, Astronomy
2013/10/20–10/25

Payne, David
U Liverpool, Neutrino Physics
2014/01/27–01/28

Pecontal, Arlette
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2013/05/19–05/22

Percacci, Roberto
SISSA, Particle Theory
2013/10/01–10/11

Perkin, Jonathan
U Sheffield, Neutrino Physics
2014/01/27–01/28

Perlick, Volker
ZARM, Theoretical Physics
2013/09/28–10/04

Petcov, Serguey Todorov
SISSA, Particle Theory
2013/03/19–04/21, 07/05–07/09, 11/01–11/22, 2014/02/20–04/04

Pinzon, Elder
York U, Neutrino Physics
2014/01/27–01/28

Plefka, Jan
Humboldt U, String Theory
2013/08/29–09/08

Plehn, Tilman
Heidelberg U, Particle Theory
2013/07/16–07/19

Pollok, Jonas
Humboldt U, String Theory
2013/08/23–09/12

Pomoni, Elli
DESY, Particle Theory
2013/08/26–09/06

Pope, Adrian
ANL, Cosmology
2013/07/23–07/26

Popov, Boris
LPNHE, Experimental Physics
2013/11/11–11/13

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2014/02/09–02/15

Poutissou, Jean-Michel
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2014/01/27–01/28

Price, Paul
Princeton U, Astrophysics
2013/08/22–08/29

Priddis, Nathan
U Michigan, Mathematics
2014/02/10–02/14

Pritchard, Tyler Anthony
Penn State U, Astrophysics
2013/06/18–08/19, 08/21

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2013/06/21–06/22, 2014/01/27–01/28

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2013/10/30–11/13

Rahmati, Mohammad Reza
CIMAT, Mathematics
2014/02/09–02/15

Randall, Lisa
Harvard U, Particle Theory
2014/01/24–01/25

Rastelli, Leonardo
Stony Brook U, String Theory
2013/08/19–09/07

Ratoff, Peter
Lancaster U, Experimental Physics
2013/11/11–11/13

Ravikumar, Vijay
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Rayner, Mark
U Geneva, Neutrino Physics
2013/06/21–06/22, 2014/01/27–01/28

Razamat, Shlomo
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TU Vienna, Particle Theory
2013/09/22–09/29

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ULB, Particle Theory
2013/12/02–12/04

Reffert, Susanne
CERN, String Theory
2013/04/07–05/06, 11/18–12/20

Renshaw, Andrew
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2013/11/11–11/13

Renzini, Alvio
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2013/06/21–06/22, 11/11–11/13, 2014/01/27–01/28

Reyes, Reinabelle
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Rizzo, Giuliana
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2013/08/05, 12/12

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2013/12/01–12/04

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2013/06/04–06/06

Sacco, Roberto
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Saga, Shouhei
Nagoya U, Cosmology
2013/12/25–12/27

Saikawa, Ken'ichi
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Saito, Masahiko
Kobe U, Mathematics
2014/02/10–02/14

Saito, Yuriko
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2013/06/03, 06/05

Saitoh, Takayuki
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2013/05/23, 05/30, 06/07, 06/12

Sakai, Nobuyuki
Yamaguchi U, Particle Theory
2013/12/25–12/27

Sakai, Norisuke
Keio U, Particle Theory
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Sakakihara, Yuki
Kyoto U, Astrophysics
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Sakashita, Ken
KEK, Experimental Physics
2013/11/11–11/13

Sakurai, Yuya
U Tokyo, Astrophysics
2013/12/25–2013/12/27

Samtleben, Henning
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2014/03/10–03/15

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2013/06/21–06/22

Sanchez-Gallego, Jose
U Kentucky, Astronomy
2013/05/18–05/26

Sanders, David
U Hawaii, Astronomy
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Sandilya, Saurabh
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2013/10/05–12/04

Sasagawa, Yukinori
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2013/04/08–04/10

Sasaki, Junya
U Tokyo
2013/09/17–09/20, 09/24–09/27, 10/01, 10/09, 10/11, 10/15–10/16, 10/18, 10/23–10/25, 10/30–11/01, 11/05, 11/07–11/08, 11/18–11/20, 12/02, 12/10, 12/20, 2014/01/07, 01/10, 01/15, 01/17, 01/23–01/24, 01/28–01/29, 02/03–02/04, 02/12–02/13, 02/17–02/21, 03/04–03/05, 03/10, 03/12, 03/18, 03/20, 03/24–03/25

Sasaki, Misao
Kyoto U, Cosmology
2013/09/30–10/03

Sato, Katsuhiko
NINS, Cosmology
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Sato, Nobuhiko
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2013/04/08, 04/10–04/11, 04/22–04/26, 05/09, 05/23, 05/30, 06/07, 06/12, 06/21, 06/25, 07/16, 07/23–07/26, 07/29–07/30, 08/01–08/02, 08/05–08/07, 08/22, 08/26–08/27, 08/30, 09/04–09/05, 09/13, 09/24–09/27, 10/02–10/04, 10/07–10/11, 10/15–10/16, 10/18, 10/22–10/25, 10/28–10/29, 10/31, 11/06–11/08, 11/11, 11/19–11/22, 11/26–11/27, 12/04, 12/06, 12/09–12/10, 12/12–12/13, 12/16– 12/17, 12/19–12/20, 12/25–12/26, 2014/01/07–01/10, 01/14, 01/16–01/17, 01/20, 01/22–01/23, 01/27–01/31, 02/03–02/05, 02/07, 02/13, 02/17–02/20, 02/24, 02/27, 03/03–03/04, 03/10, 03/13, 03/17, 03/20, 03/25, 03/31

Sato, Ryosuke
KEK, Particle Theory
12/02–12/04

Sato, Yuta
Kitasato U, Particle Theory
2013/07/16–07/19

Sato, Yuushi
U Tokyo, Astronomy
2013/05/30, 08/23, 08/30, 2014/03/05–03/06

Satoh, Yuji
U Tsukuba, Particle Theory
2013/08/28–08/30

Satsuka, Tatsuya
Osaka U, Astrophysics
2013/12/25–12/27

Scantamburlo, Enrico
U Geneva, Neutrino Physics
2014/01/27–01/28

Schaan, Emmanuel
Princeton U
2013/08/07–08/29

Schaye, Joop
Leiden U, Astronomy
2013/07/22–07/29

Schmude, Johannes
RIKEN, String Theory
2013/05/06, 05/10

Scholberg, Kate
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2013/06/12–06/20

Schuller, Frederic Paul
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2013/09/28–10/10

Schulze, Andreas
KIAA, Peking U, Astronomy
2013/05/26–05/28

Scott, Mark
TRIUMF, Neutrino Physics
2014/01/27–01/28, 03/06–03/09

Scudder, Jillian
U Victoria, Astronomy
2013/09/17

Seino, Yoshiaki
Niigata U
2013/09/23–09/27, 10/01–10/11, 10/23–11/01, 11/04–11/12, 11/19–11/28, 12/01–12/13, 12/15–12/27, 2014/01/19–01/24, 02/11–02/21, 02/23–02/28, 03/02–03/07, 03/09–03/21, 03/23–03/26

Seki, Ryoichi
California State U, Northridge, Nuclear Physics
2013/09/23–09/29

Seki, Shigenori
Sogang U, String Theory
2013/09/23–09/29

Sekiguchi, Tetsuro
KEK, Experimental Physics
2013/11/11– 11/13, 2014/01/27–01/28, 03/06–03/09

Sekiguchi, Yuichiro
Kyoto U, Astronomy
2013/12/25–12/27

Sekimoto, Yutaro
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2013/11/18–11/19

Sekiya, Hiroyuki
U Tokyo, ICRR, Astroparticle Physics
2013/06/21–06/22, 11/11–11/13, 2014/01/27–01/28, 02/07

Sendouda, Yuuiti
Hirosaki U, Astrophysics
2013/12/25–12/27

Seo, Min-Seok
POSTECH, Astroparticle Physics
2013/12/02–12/04

Seo, Yunseok
Hanyang U, Particle Theory
2013/09/24–09/28

Serban, Didina
IPhT, CEA-Saclay, String Theory
2013/10/06–10/20

Seto, Naoki
Kyoto U, Astrophysics
2013/12/25–12/27

Seto, Osamu
Hokkai-Gakuen U, Particle Theory
2013/12/25–12/27

Sgalaberna, Davide
ETH Zurich, Neutrino Physics
2014/01/27–01/28

Shaevitz, Michael
Columbia U, Neutrino Physics
2014/01/27–01/28

Shah, Raj
U Oxford, Neutrino Physics
2014/01/27–01/28

Shaposhnikov, Mikhail
EPFL Lausanne, Particle Theory
2013/11/17–12/04

Sharples, Ray Martin
Durham U, Astronomy
2013/05/19–05/22

Shaw, Avirup
U Calcutta, Particle Theory
2013/07/15–07/20

Sheng, Mao
USTC, Mathematics
2013/07/24–07/31

Shibata, Masaru
Kyoto U, Astrophysics
2013/12/25–12/27

Shibata, Sanshiro
Konan U, Astrophysics
2013/12/25–12/27

Shibukawa, Youichi
Hokkaido U, Mathematics
2014/02/10–02/14

Shibusawa, Yuuki
Nagoya U, Astrophysics
2013/12/25–12/27

Shimizu, Hiroyuki
U Tokyo, Particle Theory
2014/03/10–03/20

Shimizu, Itaru
Tohoku U, High Energy Physics
2013/06/21–06/22

Shimizu, Nobuhiro
U Tokyo, High Energy Physics
2013/06/21, 09/17–09/20, 09/24–09/27, 09/30–10/04, 10/08–10/11, 10/21–10/25, 11/07–11/08, 2014/02/04

Shimoda, Jiro
Aoyama Gakuin U, Astronomy
2013/12/25–12/27

Shimomura, Takashi
Niigata U, Particle Theory
2013/12/02–12/04

Shin, Hyungseok
Seoul National U, Mathematics
2014/02/10–02/14

Shinkai, Hisaaki
Osaka Inst. Tech, Astrophysics
2013/12/25–12/27

Shinoda, Tomohiro
Osaka U, Astrophysics
2013/12/25–12/27

Shiozawa, Masato
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2013/06/21–06/22, 11/11–11/13, 12/25–12/27, 2014/01/27–01/28, 03/06–03/09

Shirai, Satoshi
UC Berkeley, Particle Theory
2013/07/29–08/02

Shiraishi, Yuuki
Osaka U, Mathematics
2013/08/05–08/16, 2014/02/10–02/14

Shirasaki, Masato
U Tokyo, Astrophysics
2013/12/25–12/27

Shiromizu, Tetsuya
Kyoto U, String Theory
2013/04/08–04/10, 10/01–10/03

Shiu, Gary
U Wisconsin, Madison, String Theory
2014/02/11–02/13

Shoji, Yutaro
Tohoku U, Particle Theory
2013/12/02–12/04

Sieg, Christoph
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2013/08/27–09/09

Siino, Masaru
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2013/04/08–04/10

Sinha, Manodeep
Vanderbilt U, Astrophysics
2013/07/21–07/26

Skuladottir, Asa
U Groningen
2014/03/26

Smirnov, Fedor
LPTHE, Mathematics
2013/12/01–12/07

Smith, Nigel
TRIUMF, High Energy Physics
2013/06/05–06/06

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2013/06/15–06/22, 12/13–12/22

Sobel, Henry W.
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2013/05/08–05/16, 06/20–06/22, 2014/01/27–01/28

Sobko, Evgeny
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2013/09/02–09/23

Sochichiu, Corneliu
GIST, String Theory
2014/01/19–01/29

Soda, Jiro
Kyoto U, Cosmology
2013/04/08–04/10

Soderberg, Mitch
Syracuse U, Experimental Physics
2013/11/11–11/13

Sonnenschein, Jacob
Tel Aviv U, Particle Theory
2013/09/21–09/29

Sorbo, Lorenzo
U Massachusetts, Amherst, Cosmology
2014/02/02–02/11

Sorokina, Elena
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2014/01/08–02/08

Spannowski, Michael
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2013/07/16–07/19

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2013/06/10–08/31

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2013/06/26–06/28

Spitz, Joshua
MIT, Experimental Physics
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U Sydney, Mathematics
2013/12/16–12/19

Staudacher, Matthias
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2013/08/26–09/08

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2013/09/23–09/28

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2014/02/10–02/14

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2013/07/16–07/19, 12/02–12/04

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2013/06/20–06/27, 11/11–11/13

Strauss, Michael
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2013/08/27–08/29

Suda, Takuma
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Suda, Yusuke
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2013/06/21–06/22, 11/11–11/13, 2014/01/27–01/28

Sugai, Kenichi
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2013/12/02–12/04

Sugimura, Kazuyuki
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2013/05/07–05/10, 12/25–12/27

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2013/12/17, 12/25–12/27

Sugiyama, Satoshi
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2014/02/10–02/14

Suh, Hyewon
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2013/05/12–05/18

Sumi, Takahiro
Osaka U, Astroparticle Physics
2013/12/25–12/27

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2013/12/25–12/27

Suwa, Yudai
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2013/12/25–12/27

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2013/12/25–12/27

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2013/11/11–11/13, 12/25–12/27

Suzuki, Mariko
Shizuoka U
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2013/08/29

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Szollosi, Ferenc
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2013/10/28–10/30

Tacik, Roman
U Regina, Experimental Physics
2014/03/06–03/09

Tada, Sho
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2013/06/21–06/22

Tagoshi, Hideyuki
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2013/12/25–12/27

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2013/12/02–12/04

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2013/12/2–12/27

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2013/07/04–07/07, 12/25–12/27

Takahashi, Ryuichi
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2013/11/11–11/12

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2013/12/25–12/27

Tatekawa, Takayuki
U Fukui, Astrophysics
2013/12/25–12/27

Taylor, Geoffrey
U Melbourne
2014/02/04

Terada, Takahiro
U Tokyo, Particle Theory
2013/07/16–07/19, 12/02–12/04

Teraki, Yuto
Osaka U, Astrophysics
2013/12/25–12/27

Terasawa, Toshio
U Tokyo, ICRR, High Energy Physics
2013/12/25–12/27

Terashi, Koji
U Tokyo, ICEPP, Experimental Physics
2013/12/02–12/04

Terri, Ryan
QMUL, Neutrino Physics
2014/01/27–01/28

Terukina, Ayumu
Hiroshima U, Astrophysics
2013/12/25–12/27

Teshima, Masahiro
U Tokyo, ICRR, Astroparticle Physics
2013/12/25–12/27

Tetsu, Hiroyuki
Tokyo Tech, Astrophysics
2013/12/25–12/27

Thakur, Ritoban Basu
U Illinois, Urbana, Particle Theory
2013/10/10–10/12

Thakurta, Puragra Guha
UC Santa Cruz, Astronomy
2013/06/27

Thanjavur, Karun
U Victoria, Cosmology
2013/05/18–05/25

Thomas, Raje
Tata Inst, High Energy Physics
2013/10/05–10/26

Thompson, Lee
U Sheffield, Neutrino Physics
2014/01/27–01/28

Tinker, Jeremy
New York U, Cosmology
2013/07/21–07/27

Tobayama, Shimpei
U British Columbia, High Energy Physics
2013/11/11–11/13, 2014/01/27–01/28

Tolstov, Alexey
RIKEN, Astrophysics
2013/05/13

Toma, Kenji
Osaka U, Astroparticle Physics
2013/12/25–12/27

Tomasiello, Alessandro
Universita di Milano-Bicocca, String Theory
2014/03/10–03/15

Tominaga, Nozomu
Konan U, Astrophysics
2013/06/26, 08/27, 11/22, 12/25–12/27, 2014/02/25

Torii, Takashi
Osaka Inst Tech, Particle Theory
2013/12/25–12/27

Toriumi, Shin
U Tokyo, Astrophysics
2013/12/25–12/27

Tornow, Werner
Duke U, Neutrino Physics
2013/04/15–04/24, 2014/01/19–01/29

Torrieri, Giorgio
Columbia U, Nuclear Physics
2013/12/08–12/10

Torrome, Ricardo Gallego,
Universidade Federal de Sao Carlos (UFSCar), Mathematical Physics
2013/09/30–10/04

Trevisani, Emilio
U Porto, String Theory
2013/08/11–09/15

Tseng, Hsian-Hua
Ohio State U, Mathematics
2013/06/20–06/25

Tsuboyama, Toru
KEK, High Energy Physics
2013/04/08, 04/10–04/11, 04/15–04/16, 04/18–04/19, 04/22–04/26, 05/09, 05/13–05/15, 05/21, 05/23–05/24, 05/30, 06/07, 06/25, 07/18, 07/26, 07/30, 08/02, 08/05–08/07, 08/20, 08/27, 09/09, 09/13, 09/19, 10/21, 10/24, 12/09, 12/20, 2014/01/16, 02/04, 02/18, 02/27–02/28, 03/11, 03/17–03/18

Tsuji, Yusuke
Osaka U, Astrophysics
2013/12/25–12/27

Tsukamoto, Toshifumi
KEK, High Energy Physics
2013/06/21–06/22

Tsukamoto, Yusuke
Nagoya U, Astrophysics
2013/12/25–12/27

Tsuribe, Toru
Osaka U, Astrophysics
2013/12/25–12/27

Tsuruta, Sachiko
Montana State U, Astrophysics
2013/05/23–05/27, 06/03–06/07, 06/12–06/18, 12/12–12/31

Turner, Edwin L.
Princeton U, Astrophysics
2013/05/05–05/18, 10/16–11/03, 2014/01/19–02/01

Uchiyama, Fumiyo
KEK, Particle Theory
2013/07/16–07/19

Ueda, Kazushi
Osaka U, Mathematics
2013/07/10–07/13

Ueno, Koh
Osaka U, Astrophysics
2013/12/25–12/27

Ueta, Shoji
Tokyo Tech, Astrophysics
2013/12/25–12/27

Ukawa, Akira
U Tsukuba, Mathematical Physics
2013/06/12

Umeeda, Hiroyuki
Hiroshima U, Particle Theory
2013/07/15–07/20

Umemura, Masayuki
U Tsukuba, Astroparticle Physics
2013/12/25–12/27

Uozumi, Satoru
Kyungpook National U, High Energy Physics
2014/02/04, 02/12–02/21

Ushiroda, Yutaka
KEK, High Energy Physics
2013/06/07, 11/26

Uzan, Jean-Philippe
IAP, Cosmology
2013/09/28–10/05

Vafa, Cumrun
Harvard U, String Theory
2013/06/11

van den Bosch, Franciscus
Yale U, Cosmology
2013/07/20–08/04

van der Schee, Wilke
Utrecht U, String Theory
2013/09/23–09/29

van Garrel, Michel
KIAS, Mathematics
2014/02/10–02/14

van Rees, Balt
Stony Brook U, Particle Theory
2013/08/25–09/08

Volansky, Tomer
Tel Aviv U, Particle Theory
2013/12/01–12/04

Volkov, Mikhail
U Tours, Gravity
2013/04/03–04/16

Volpi, Matteo
IFAE-Barcelona,
2014/02/04

Voronov, Alexander
U Minnesota, Mathematics
2013/11/05–12/05

Wacker, Jay G.
SLAC, High Energy Physics
2014/03/27–04/02

Wake, David
U Wisconsin, Madison, Astronomy
2013/05/19–05/23

Waldram, Daniel J.
Imperial College London, Theoretical Physics
2014/03/10–03/13

Wall, Aron
UC Santa Barbara, High Energy Physics
2013/12/16–12/20

Walter, Christopher
Duke U, Neutrino Physics
2013/06/21–06/27

Walters, Matthew Thomas
Johns Hopkins U, Particle Theory
2013/06/18–08/19

Wanajo, Shinya
NAOJ, Astronomy
2013/08/27, 12/25–12/27

Wang, Anzhong
Baylor U, Cosmology
2013/06/09–06/24

Wang, Dongning
IBS, POSTECH, Mathematics
2014/02/09–02/14

Wardell, Barry
U College Dublin, Cosmology
2013/06/18

Wark, David
Rutherford Appleton Lab, Neutrino Physics
2013/06/21–06/22, 11/11–11/13

Watanabe, Haruki
U Tokyo, Condensed Matter Physics
2014/01/06–01/10

Watanabe, Yuki
U Tokyo, RESCEU, Cosmology
2013/04/08–04/10, 12/25–12/27

Weatherly, Pierce
UC Irvine, Experimental Physics
2013/11/11–11/13

Webber, Bryan
U Cambridge, Particle Theory
2013/07/15–07/21, 2014/02/17–05/16

Wechsler, Risa
Stanford U, Cosmology
2013/07/21–07/28

Weijmans, Anne-Marie
U Toronto, Astrophysics
2013/05/14–05/27

Weinstein, Alan
UC Berkeley,
2013/11/02–11/07

Wemyss, Michael
U Edinburgh, Mathematics
2013/09/30–10/01

Wen, Hao
Peking U, Mathematics
2014/02/09–02/16

Wendell, Roger Alexandre
U Tokyo, ICRR, Neutrino Physics
2013/06/21–06/22, 11/11–11/13,
2014/01/27–01/28

Wetzel, Andrew
Yale U, Astrophysics
2013/07/22–07/27

White, Martin
UC Berkeley, Cosmology
2013/07/13–07/31

Whitehead, Leigh
U College London, High Energy Physics
2013/11/11, 11/13

Wilhelm, Matthias
Humboldt U, String Theory
2013/08/24–09/17

Wilking, Michael
TRIUMF, Neutrino Physics
2013/06/21–06/22, 11/11–11/13,
2014/01/27–01/28, 03/06–03/09

Wilson, Jeanne
QMUL, Neutrino Physics
2014/01/27–01/28

Winter, Walter
U Wurzburg, Astroparticle Physics
2013/10/28–10/30

Witaszczyk, Przemek
Jagiellonian U, String Theory
2013/09/24–09/27

Wolfson, Jesse
Northwestern U, Mathematics
2013/09/06–2014/08/31

Wood, Simon James
Australian National U, Mathematical
Physics
2014/01/13–01/24, 03/31–04/04

Wu, Jackson
National Center for Theoretical Sciences,
String Theory
2014/03/17–03/26

Wu, Siye
Chinese U Hong Kong, Mathematics
2013/07/08–07/11

Xu, Benda
Tohoku U, Experimental Physics
2013/11/11–11/13

Yagai, Masumi
Tokyo U of Science, Astrophysics
2013/11/11–11/13

Yahiro, Kohei
U Tokyo, Mathematics
2014/02/10–02/14

Yamada, Masaki
U Tokyo, ICRR,
2013/04/08–04/10

Yamada, Miyuki
Ochanomizu U, Astrophysics
2013/12/25–12/27

Yamada, Toru
Tohoku U, Astronomy
2013/11/20–11/22

Yamada, Toshifumi
KEK, Particle Theory
2013/07/16–07/19

Yamagami, Shigeru
Nagoya U, Mathematics
2014/03/10–03/20

Yamaguchi, Masahide
Tokyo Tech, Cosmology
2013/04/08– 04/10

Yamaguchi, Masaki
NAOJ, Astronomy
2013/12/25–12/27

Yamaguchi, Masayuki
Hosei U, Astrophysics
2013/12/25–12/27

Yamaguchi, Satoshi
Osaka U, String Theory
2013/04/18–04/19

Yamamoto, Kei
Niigata U, Particle Theory
2013/12/02–12/04

Yamamoto, Shimpei
U Tokyo, ICEPP, Particle Theory
2013/09/11, 2013/12/02–12/04

Yamamoto, Tokonatsu
Konan U, Astroparticle Physics
2013/12/25–12/27

Yamamoto, Yasuhiro
U Tokyo, Particle Theory
2013/07/16–07/19

Yamasawa, Daisuke
Tohoku U, Astronomy
2013/12/25–12/27

Yamashita, Yasuho
Kyoto U, Cosmology
2013/12/25–12/27

Yamauchi, Daisuke
U Tokyo, RESCEU, Cosmology
2013/12/25–12/27

Yamauchi, Hiroshi
Tokyo Woman's Christian U, Mathematics
2014/03/31

Yamazaki, Masahito
IAS, String Theory
2013/09/02–09/07

Yamazaki, Ryo
Aoyama Gakuin U, Astroparticle Physics
2013/12/25–12/27

Yan, Renbin
U Kentucky, Astrophysics
2013/05/18–05/24

Yan, Wenbin
Caltech, String Theory
2013/08/31–09/07

Yano, Takatomi
Okayama U, Neutrino Physics
2013/06/21–06/22, 2014/01/27–01/28

Yasuda, Osamu
Tokyo Metropolitan U, Particle Theory
2013/11/11–11/13

Yi, Piljin
KIAS, String Theory
2013/12/01–12/13

Yokoyama, Jun'ichi
U Tokyo, RESCEU, Astrophysics
2013/12/25–12/27

Yokoyama, Masashi
U Tokyo, High Energy Physics
2013/06/21–06/22, 11/11–11/13,
2014/01/27–01/28, 03/06–03/09

Yokoyama, Shuichiro
U Tokyo, ICRR, Cosmology
2013/04/08–04/10, 07/16–07/19, 12/25–
12/27

Yokoyama, Takaaki
U Tokyo, Astrophysics
2013/12/25–12/27

Yoon, Sung-Chul
Seoul National U, Astrophysics
2013/06/24–06/28

Yoshida, Daisuke
Tokyo Tech, Cosmology
2013/04/08–04/10

Yoshida, Kentaroh
Kyoto U, Particle Theory
2013/08/27–08/29

Yoshida, Kento
Kyoto U, Experimental Physics
2013/11/11–11/13

Yoshida, Takashi
Kyoto U, Astronomy
2013/12/25–12/27

Yoshida, Yutaka
KEK, String Theory
2014/03/10–03/20

Yoshikawa, Kohji
U Tsukuba, Astrophysics
2013/12/25–12/27

Yoshioka, Satoshi
Tokyo U of Marine Science and
Technology, Astrophysics
2013/12/25–12/27

Yuan, C.-P.
Michigan State U, High Energy Physics
2013/07/15–07/20

Zahed, Ismail
Stony Brook U, Nuclear Physics
2013/09/22–09/27

Zahid, Jabran
U Hawaii, Astronomy
2013/05/06–05/18

Zaritsky, Dennis
U Arizona, Astronomy
2013/05/19–05/22

Zenitani, Seiji
NAOJ, Astronomy
2013/12/25–12/27

Zentner, Andrew
U Pittsburgh, Cosmology
2013/07/20–07/27

Zhang, Ying-li
Kyoto U, Cosmology
2013/04/08–04/10

Zhang, Youjin
Tsinghua U, Beijing, Mathematics
2014/02/09–02/15

Zhdanovskiy, Ilya
Moscow Institute of Physics and
Technology State U, Mathematics
2013/08/13–09/01

Zheng, Ya-Juan
National Taiwan U, Particle Theory
2013/07/15–07/20

10 Publications

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1. The Omega Deformed B-model for Rigid N=2 Theories
M.X. Huang, A.K. Kashani-Poor, A. Klemm
Annales Henri Poincare, **14** (2013) 425–497

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Y. Tamura, Y. Matsuda, S. Ikarashi, K.S. Scott, B. Hatsukade, H. Umehata, T. Saito, K. Nakanishi, M.S. Yun, H. Ezawa, D.H. Hughes, D. Iono, R. Kawabe, K. Kohno, G.W. Wilson
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3. Cosmological constraints from a combination of galaxy clustering and lensing–II. Fisher matrix analysis
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4. Cosmological constraints from a combination of galaxy clustering and lensing–III. Application to SDSS data
M. Cacciato, F.C. van den Bosch, S. More, H.J. Mo, X.H. Yang
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5. Synthetic light curves of shocked dense circumstellar shells
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6. Hubble-induced mass from MSSM plasma
M. Kawasaki, F. Takahashi, T. Takesako
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7. Removing the ISW-lensing bias from the local-form primordial non-Gaussianity estimation
J. Kim, A. Rotti, E. Komatsu
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8. Resurgent Analysis of the Witten Laplacian in One Dimension–II
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9. THE CLASSICAL LIMIT OF REPRESENTATION THEORY OF THE QUANTUM PLANE
I.C.H. Ip
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10. Model independent analysis of interactions between dark matter and various quarks
B. Bhattacherjee, D. Choudhury, K. Harigaya, S. Matsumoto, M.M. Nojiri
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11. Light-like tachyon condensation in open string field theory
S. Hellerman, M. Schnabl
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12. Supercurrent, supervirial, and superimprovement
Y. Nakayama
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13. Precision modeling of redshift-space distortions from a multipoint propagator expansion
A. Taruya, T. Nishimichi, F. Bernardeau
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14. MAPPING H-BAND SCATTERED LIGHT EMISSION IN THE MYSTERIOUS SR21 TRANSITIONAL DISK
K.B. Follette, M. Tamura, J. Hashimoto, B. Whitney, C. Grady, L. Close, S.M. Andrews, J. Kwon, J. Wisniewski, T.D. Brandt, S. Mayama, R. Kandori, R.B. Dong, L. Abe, W. Brandner, J. Carson, T. Currie, S.E. Egner, M. Feldt, M. Goto, O. Guyon, Y. Hayano, M. Hayashi, S. Hayashi, T. Henning, K. Hodapp, M. Ishii, M. Iye, M. Janson, G.R. Knapp, T. Kudo, N. Kusakabe, M. Kuzuhara, M.W. McElwain, T. Matsuo, S. Miyama, J.I. Morino, A. Moro-Martin, T. Nishimura, T.S. Pyo, E. Serabyn, H. Suto, R. Suzuki, M. Takami, N. Takato, H. Terada, C. Thalmann, D. Tomono, E.L. Turner, M. Watanabe, T. Yamada, H. Takami, T. Usuda
Astrophysical Journal, **767** (2013) 10

15. PRODUCTION OF ^{9}Be THROUGH THE α-FUSION REACTION OF METAL-POOR COSMIC RAYS AND STELLAR FLARES
M. Kusakabe, M. Kawasaki
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16. THE BLACK HOLE-BULGE MASS RELATION OF ACTIVE GALACTIC NUCLEI IN THE EXTENDED CHANDRA DEEP FIELD-SOUTH SURVEY
M. Schramm, J.D. Silverman
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17. THE ATACAMA COSMOLOGY TELESCOPE: RELATION BETWEEN GALAXY CLUSTER OPTICAL RICHNESS AND SUNYAEV-ZEL'DOVICH EFFECT
N. Sehgal, G. Addison, N. Battaglia, E.S. Battistelli, J.R. Bond, S. Das, M.J. Devlin, J. Dunkley, R. Dunner, M. Gralla, A. Hajian, M. Halpern, M. Hasselfield, M. Hilton, A.D. Hincks, R. Hlozek, J.P. Hughes, A. Kosowsky, Y.T. Lin, T. Louis, T.A. Marriage, D. Marsden, F. Menanteau, K. Moodley, M.D. Niemack, L.A. Page, B. Partridge, E.D. Reese, B.D. Sherwin, J. Sievers, C. Sifon, D.N. Spergel, S.T. Staggs, D.S. Swetz, E.R. Switzer, E. Wollack
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19. Axino dark matter with R-parity violation and 130 GeV gamma-ray line
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20. Emergence of time in power-counting renormalizable Riemannian theory of gravity
S. Mukohyama
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21. EARLY ULTRAVIOLET/OPTICAL EMISSION OF THE TYPE Ib SN 2008D
M.C. Bersten, M. Tanaka, N. Tominaga, O.G. Benvenuto, K. Nomoto
Astrophysical Journal, **767** (2013) 143

22. SN 2009js AT THE CROSSROADS BETWEEN NORMAL AND SUBLUMINOUS TYPE IIP SUPERNOVAE: OPTICAL AND MID-INFRARED EVOLUTION
P. Gandhi, M. Yamanaka, M. Tanaka, T. Nozawa, K.S. Kawabata, I. Saviane, K. Maeda, T.J. Moriya, T. Hattori, M. Sasada, R. Itoh
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23. THE CLUSTERING OF GALAXIES IN THE SDSS-III BARYON OSCILLATION SPECTROSCOPIC SURVEY: LUMINOSITY AND COLOR DEPENDENCE AND REDSHIFT EVOLUTION
H. Guo, I. Zehavi, Z. Zheng, D.H. Weinberg, A.A. Berlind, M. Blanton, Y.M. Chen, D.J. Eisenstein, S. Ho, E. Kazin, M. Manera, C. Maraston, C.K. McBride, S.E. Nuza, N. Padmanabhan, J.K. Parejko, W.J. Percival, A.J. Ross, N.P. Ross, L. Samushia, A.G. Sanchez, D.J. Schlegel, D.P. Schneider, R.A. Skibba, M.E.C. Swanson, J.L. Tinker, R. Tojeiro, D.A. Wake, M. White, N.A. Bahcall, D. Bizyaev, H. Brewington, K. Bundy, L.N.A. da Costa, G. Ebelke, E. Malanushenko, V. Malanushenko, D. Oravetz, G. Rossi, A. Simmons, S. Snedden, A. Streblyanska, D. Thomas
Astrophysical Journal, **767** (2013) 122

24. PRODUCTION OF CARBON-RICH PRESOLAR GRAINS FROM MASSIVE STARS
M. Pignatari, M. Wiescher, F.X. Timmes, R.J. de Boer, F.K. Thielemann, C. Fryer, A. Heger, F. Herwig, R. Hirschi, C. NuGrid
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P. Valageas, T. Nishimichi, A. Taruya
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26. Radion-Higgs-boson mixing state at the LHC with the Kaluza-Klein contributions to the production and decay
H. Kubota, M. Nojiri
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27. Mass splitting between charged and neutral winos at two-loop level
M. Ibe, S. Matsumoto, R. Sato
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T. Abu-Zayyad, R. Aida, M. Allen, R. Anderson, R. Azuma, E. Barcikowski, J.W. Belz, D.R. Bergman, S.A. Blake, R. Cady, B.G. Cheon, J. Chiba, M. Chikawa, E.J. Cho, W.R. Cho, H. Fujii, T. Fujii, T. Fukuda, M. Fukushima, W. Hanlon, K. Hayashi, Y. Hayashi, N. Hayashida, K. Hibino, K. Hiyama, K. Honda, T. Iguchi, D. Ikeda, K. Ikuta, N. Inoue, T. Ishii, R. Ishimori, D. Ivanov, S. Iwamoto, C.C.H. Jui, K. Kadota, F. Kakimoto, O. Kalashev, T. Kanbe, K. Kasahara, H. Kawai, S. Kawakami, S. Kawana, E. Kido, H.B. Kim, H.K. Kim, J.H. Kim, K. Kitamoto, S. Kitamura, Y. Kitamura, K. Kobayashi, Y. Kobayashi, Y. Kondo, K. Kuramoto, V. Kuzmin, Y.J. Kwon, J. Lan, S.I. Lim, S. Machida, K. Martens, T. Matsuda, T. Matsuura, T. Matsuyama, J.N. Matthews, M. Minamino, K. Miyata, Y. Murano, I. Myers, K. Nagasawa, S. Nagataki, T. Nakamura, S.W. Nam, T. Nonaka, S. Ogio, M. Ohnishi, H. Ohoka, K. Oki, D. Oku, T. Okuda, A. Oshima, S. Ozawa, I.H. Park, M.S. Pshirkov, D.C. Rodriguez, S.Y. Roh, G. Rubtsov, D. Ryu, H. Sagawa, N. Sakurai, A.L. Sampson, L.M. Scott, P.D. Shah, F. Shibata, T. Shibata, H. Shimodaira, B.K. Shin, J.I. Shin, T. Shirahama, J.D. Smith, P. Sokolsky, B.T. Stokes, S.R. Stratton, T. Stroman, S. Suzuki, Y. Takahashi, M. Takeda, A. Taketa, M. Takita, Y. Tameda, H. Tanaka, K. Tanaka, M. Tanaka, S.B. Thomas, G.B. Thomson, P. Tinyakov, I. Tkachev, H. Tokuno, T. Tomida, S. Troitsky, Y. Tsunesada, K. Tsutsumi, Y. Tsuyuguchi, Y. Uchihori, S. Udo, H. Ukai, G. Vasiloff, Y. Wada, T. Wong, M. Wood, Y. Yamakawa, R. Yamane, H. Yamaoka, K. Yamazaki, J. Yang, Y. Yoneda, S. Yoshida, H. Yoshii, X. Zhou, R. Zollinger, Z. Zundel
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30. EVOLUTION OF GALAXIES AND THEIR ENVIRONMENTS AT z=0.1-3 IN COSMOS
N. Scoville, S. Arnouts, H. Aussel, A. Benson, A. Bongiorno, K. Bundy, M.A.A. Calvo, P. Capak, M. Carollo, F. Civano, J. Dunlop, M. Elvis, A. Faisst, A. Finoguenov, H. Fu, M. Giavalisco, Q. Guo, O. Ilbert, A. Iovino, M. Kajisawa, J. Kartaltepe, A. Leauthaud, O. Le Fevre, E. LeFloch, S.J. Lilly, C.T.C. Liu, S. Manohar, R. Massey, D. Masters, H.J. McCracken, B. Mobasher, Y.J. Peng, A. Renzini, J. Rhodes, M. Salvato, D.B. Sanders, B.D. Sarvestani, C. Scarlata, E. Schinnerer, K. Sheth, P.L. Shopbell, V. Smolcic, Y. Taniguchi, J.E. Taylor, S.D.M. White, L. Yan
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JCAP **1405** (2014) 046, arXiv:1403.5823 [astro-ph.CO]

IPMU14-0067
Shinsuke Kawai, Yu Nakayama
Improvement of energy-momentum tensor and non-Gaussianities in holographic cosmology
JHEP **1406** (2014) 052, arXiv:1403.6220 [hep-th]

IPMU14-0068
Michael Czerny, Tetsutaro Higaki, Fuminobu Takahashi
Multi-Natural Inflation in Supergravity and BICEP2
Phys. Lett. B **734** (2014) 167–172, arXiv:1403.5883 [hep-ph]

IPMU14-0069
Cancelled

IPMU14-0070
Keisuke Harigaya, Masahiro Ibe, Koji Ichikawa, Kunio Kaneta, Shigeki Matsumoto
High-Scale SUSY Breaking Models in light of the BICEP2 Result
JHEP **1407** (2014) 093, arXiv:1403.5880 [hep-ph]

IPMU14-0071
Satyanarayan Mukhopadhyay, Mihoko M. Nojiri, Tsutomu T. Yanagida
Compressed SUSY search at the 13 TeV LHC using kinematic correlations and structure of ISR jets
JHEP **1410** (2014) 012, arXiv:1403.6028 [hep-ph]

IPMU14-0072
Ivan Girardi, Aurora Meroni, S.T. Petcov, Martin Spinrath,
Generalised geometrical CP violation in a T' lepton flavour model
JHEP **1402** (2014) 050, arXiv:1312.1966 [hep-ex]

IPMU14-0073
Ivan Girardi, Aurora Meroni, S.T. Petcov
Neutrinoless Double Beta Decay in the Presence of Light Sterile Neutrinos
JHEP **1311** (2013) 146, arXiv:1308.5802 [hep-ex]

IPMU14-0074
D.N. Dinh, S.T. Petcov
Lepton Flavor Violating τ Decays in TeV Scale Type I See-Saw and Higgs Triplet Models
JHEP **1309** (2013) 086, arXiv:1308.4311 [hep-ex]

IPMU14-0075
M. Fabbrichesi, S. Petcov
Low-scale seesaw and dark matter
EPJ C **74** (2014) 2774, arXiv:1304.4001 [hep-ex]

IPMU14-0076
S.T. Petcov
The Nature of Massive Neutrinos
Adv. High Energy Phys. **2013** (2013) 852987, arXiv:1303.5819 [hep-ex]

IPMU14-0077
David Marzocca, S.T. Petcov, Andrea Romanino, M.C. Sevilla
Nonzero $|U_{e3}|$ from Charged Lepton Corrections and the Atmospheric Neutrino Mixing Angle
JHEP **1305** (2013) 073, arXiv:1302.0423 [hep-ex]

IPMU14-0078
A. Meroni, S.T. Petcov, F. Simkovic
Multiple CP Non-conserving Mechanisms of $(\beta\beta)_{0\nu}$-Decay and Nuclei with Largely Different Nuclear Matrix Elements
JHEP **1302** (2013) 025, arXiv:1212.1331 [hep-ex]

IPMU14-0079
Haruki Nishino et al. (POLARBEAR Collaboration)
POLARBEAR CMB Polarization Experiment
JPS Conf. Proc. **1** (2014) 013107

IPMU14-0080
Tomoki Saito, Yuichi Matsuda, Cedric G. Lacey, Ian Smail, Alvaro Orsi, Carlton M. Baugh, Akio K. Inoue, Ichi Tanaka, Toru Yamada, Kouji Ohta, Carlos De Breuck, Tadayuki Kodama, Yoshiaki Taniguchi
The environment of Lyα blobs I: Wide-field Lyα imaging of TN J1338-1942, a powerful radio galaxy at z~4.1 associated with a giant Lyα nebula
arXiv:1403.5924 [astro-ph.GA]

IPMU14-0081
Hiroyuki Ishida, Fuminobu Takahashi
$U(1)_{B-L}$ Symmetry Restoration and Effective Neutrino Species
Phys. Lett. B **734** (2014) 183–187, arXiv:1403.6460 [hep-ph]

IPMU14-0082
Brian Henning, Xiaochuan Lu, Hitoshi Murayama,
What do precision Higgs measurements buy us?
arXiv:1404.1058 [hep-ph]

IPMU14-0083
W. Buchmuller, V. Domcke, K. Kamada, K. Schmitz
Hybrid Inflation in the Complex Plane
JCAP **1407** (2014) 054, arXiv:1404.1832 [hep-ph]

IPMU14-0084
Antonio De Felice, A. Emir Gumrukcuoglu, Shinji Mukohyama, Norihiro Tanahashi, Takahiro Tanaka
Viable cosmology in bi-metric theory
JCAP **1406** (2014) 037, arXiv:1404.0008 [hep-th]

IPMU14-0085
K. Nakayama, F.Takahashi, T.T.Yanagida,
Anomaly-free flavor models for Nambu-Goldstone bosons and the 3.5 keV X-ray line signal
Phys. Lett. B **734** (2014) 178–182, arXiv:1403.7390 [hep-ph]

12 Conference Presentations and Seminar Talks

Seminar talks given at the Kavli IPMU are not included. For seminar talks given at the Kavli IPMU, see Section 8.

FY2013

Lie Groups and Representation Theory Seminar
(2013.04.02, Graduate School of Mathematical Sciences, U Tokyo)
Yoshiki Oshima
Discrete branching laws of Zuckerman's derived functor modules

Algebraic Geometry Seminar
(2013.04.03, U Georgia, Athens)
Charles Siegel
Prym Varieties of Cyclic Covers

2nd Workshop on Particle Physics of the Dark Universe
(2013.04.04, U Tokyo)
Takeo Higuchi
Belle II and Flavor Physics

Snowmass Energy Frontier Workshop
(2013.04.05, BNL)
Hitoshi Murayama
Japan ILC Proposal

Kavli IPMU mini-workshop on Massive Gravity and its Cosmological Implications
(2013.04.08–04.10, Kavli IPMU)
Emir Gumrukcuoglu
Stability of cosmological solutions in massive gravity

The deaths of stars and the lives of galaxies
(2013.04.08–04.12, Santiago, Chile)
Takashi Moriya
Revealing Explosive Mass Loss Decades before Massive Star Explosions from Type IIn Supernova Light Curve Modeling

Mitchell Institute workshop on supernovae and cosmology
(2013.04.09–04.11, Texas A&M)
Keiichi Maeda
A Few Issues in CSM Interaction Signals and on Mass Loss Estimate

Algebraic Geometry Seminar
(2013.04.11, Johns Hopkins U)
Charles Siegel
Prym Varieties of Cyclic Covers

Cluster Lensing: Peering into the Past, Planning for the Future
(2013.04.15–04.17, STScI, Baltimore, USA)
Masamune Oguri
The shape of cluster-scale dark matter halos

Seminar at U Chile
(2013.04.16, Cerro Calan, Santiago, Chile)
Takashi Moriya
Interactions between Core-Collapse Supernovae and Circumstellar Medium

Cosmology Beyond the Power Spectrum
(2013.04.17–04.19, LBNL/UC Berkeley)
Shun Saito
Understanding non-local halo bias combining power spectrum and bispectrum of halo clustering

Algebra Seminar
(2013.04.17, Rutgers U)
Charles Siegel
Cyclic Covers, Prym Varieties and the Schottky-Jung Relations

Seminar at Ochanomizu U
(2013.04.18, Ochanomizu U, Tokyo)
Marcus Werner
Mathematics of gravitational lensing: new developments

The International Workshop on Complex Geometry
(2013.04.18–04.19, Chinese U Hong Kong)
Changzheng Li
Primitive forms via polyvector fields

Seminar on Geometric representation theory and Quantum integrable system
(2013.04.20, U Tokyo)
Ivan Chi-Ho Ip
Positive Representations: Motivation, Construction and Braiding Structure

PANDA symposium on Multi-messenger Astronomy
(2013.04.22–04.26, Xi'an, China)
Keiichi Maeda
Electron Acceleration in Supernovae

Math-Physics Joint Seminar
(2013.04.23, U Pennsylvania)
Charles Siegel
Prym Varieties of Cyclic Covers

Colloquium at Kanazawa U
(2013.04.24, Kanazawa U)
Tatsu Takeuchi
Galois Theory for Physicists: Spontaneous Symmetry Breaking and the Solution to the Quintic

Seminar at Kanazawa U
(2013.04.25, Kanazawa U)
Tatsu Takeuchi
Analytical Approximation of the Neutrino Oscillation Probabilities at large θ_{13}

Algebraic Geometry and Number Theory Seminar
(2013.04.25, Boston College)
Charles Siegel
The Schottky Problem in genus 5

Seminar at Kanazawa U
(2013.04.26, Kanazawa U)
Tatsu Takeuchi
Some Mutant Forms of Quantum Mechanics

Seminar at IoA, U Tokyo
(2013.04.26, IoA, U Tokyo)
Malte Schramm
The co-evolution between black hole and galaxy over the past 12 billion years

Math Seminar
(2013.04.29, Hong Kong U of S&T)
Changzheng Li
Primitive forms via polyvector fields

Algebra, Geometry and Physics
(2013.05.01, Stony Brook U)
Charles Siegel
The Schottky Problem in genus 5

Student's visit from Leiden
(2013,05.01, Kavli IPMU)
Surhud More
Cosmology at Kavli IPMU

PHENO 2013
(2013.05.06–05.08, U Pittsburgh)
Sourav K. Mandal
Top Polarization and Stop Mixing from Boosted Jet Substructure

Theoretical Physics Colloquium at Rikkyo U
(2013.05.07, Rikkyo U, Tokyo)
Norihiro Tanahashi
Horizon instability of an extreme Reissner-Nordstrom black hole

Fifty-One Ergs
(2013.05.13–05.17, Raleigh, NC, USA)
Takashi Moriya
Luminous Blue Variable SN Progenitors with Episodic SN Radio Light Curve Modulations

Math Seminar
(2013.05.13, Tongji U, Shanghai)
Changzheng Li
Schubert calculus: from classical to quantum

Analysis Seminar
(2013.05.14, Chalmers U of Technology and U Gothenburg, Sweden)
Toshiyuki Kobayashi
Branching Laws and F-method for Constructing Natural Differential Operators in Parabolic Geometry

Nobel Symposium on LHC results
(2013.05.16, Krusenberg, Sweden)
Hitoshi Murayama
Future Experimental Programs

Seminar at IAP
(2013.05.17, IAP, Paris)
Shinji Mukohyama
From configuration to dynamics

Colloquium
(2013.05.20, Chalmers U of Technology and U Gothenburg, Sweden)
Toshiyuki Kobayashi
Global Geometry and Analysis on Locally Pseudo-Riemannian Homogeneous Spaces

2013 COSMOS Team Meeting
(2013.05.20–05.24, Kyoto U)
Takashi Moriya
High-*z* superluminous supernova survey with HSC and SPLASH

2013 COSMOS Team Meeting
(2013.05.20–2013.05.24, Kyoto U)
Claire Lackner
Extremely Close Pairs in COSMOS

2013 COSMOS Team Meeting
(2013.05.20–2013.05.24, Kyoto U)
Hitoshi Murayama
Dark Matter and Dark Energy from Particle Physicists' Perspective

Planck 2013
(2013.05.20, Bonn, Germany)
Hitoshi Murayama
Are we done with the LHC?

IAU Symposia 298: Setting the scene for Gaia and LAMOST
(2013.05.20–05.24, Lijiang, China)
Miho N. Ishigaki
Chemical differences and similarities among the kinematically selected thick disk, inner halo and outer halo stars

IAU Symposia 298: Setting the scene for Gaia and LAMOST
(2013.05.20–05.24, Lijiang, China)
Ken'ichi Nomoto
Supernova Yields for Chemical Evolution Modeling

Seminar
(2013.05.22, Kyoto Sangyo U)
Masahiro Takada
Cosmic structure formation: dark matter and neutrinos

N=2 Jeometry And ApplicationZ workshop Part II
(2013.05.22–05.24, McGill U, Montreal, Canada)
Richard Eager
Superconformal indices in dimensions 2, 3, and 4

Frascati Workshop 2013: Multifrequency Behaviour of High Energy Cosmic Sources
(2013.05.27–06.02, Palermo, Italy)
Keiichi Maeda
Expected Hard X-Rays And Gamma-Rays from SNe Ia

Frascati Workshop 2013: Multifrequency Behaviour of High Energy Cosmic Sources
(2013.05.27–06.01, Palermo, Italy)
Keiichi Maeda
Young Supernovae and Electron acceleration mechanism: Millimeter Perspectives

ECFA2013
(2013.05.27–05.31, DESY)
Shigeki Matsumoto
Asymmetric Dark Matter at ILC

Modern aspects of cosmology
(2013.05.28, LPT, Orsay)
Emir Gumrukcuoglu
Cosmology in Massive Gravity and Its Extensions

Seminar at Naresuan U
(2013.05.29, Naresuan, Thailand)
Shinji Mukohyama
From configuration to dynamics

Symposium on middle-scale projects in astronomy and astrophysics
(2013.05.29, Science Council of Japan)
Hitoshi Murayama
PFS

Spring School 2013 of High Energy Physics
(2013.05.30–2013.06.01, Shiga, Japan)
Takeo Higuchi
Belle II

IEU Cosmology Conference 2013: Reconstructing the Universe
(2013.06.03–2013.06.05, IEU, Seoul, Korea)
Masahiro Takada
Can we use galaxy clustering for precision cosmology?—connecting galaxies and dark matter halos (invited talk)

Group Actions with applications in Geometry and Analysis
(2013.06.03–06.06, Universite de Reims)
Toshiyuki Kobayashi
Branching, Multiplicities, and Real Spherical Varieties

IEU Cosmology 2013
(2013.06.03, Seoul, Korea)
Hitoshi Murayama
Topology and Cosmology

Seminar
(2013.06.04–06.05, Nagoya U)
Rene Meyer
Hydrodynamics in 2+1 and 3+1 dimensions, and Holography

Group Actions with applications in Geometry and Analysis in honour of Toshiyuki Kobayashi 50th birthday
(2013.06.05, Universite de Reims)
Yoshiki Oshima
Discrete branching laws of Zuckerman's derived functor modules

Tohoku Workshop on Higgs and Beyond
(2013.06.05–06.09 , Tohoku U)
Shigeki Matsumoto
Phenomenology of Wino Dark Matter

Seminar at SISSA
(2013.06.06, SISSA, Trieste, Italy)
Emir Gumrukcuoglu
Cosmology in Massive Gravity and Its Extensions

Seminar at Nagoya U
(2013.06.07, Nagoya U)
Shigeki Sugimoto
Confinement and Dynamical Symmetry Breaking in non-SUSY Gauge Theory from S-duality in String Theory

2nd Mediterranean Conference on Classical and Quantum Gravity
(2013.06.09–06.15, Veli Lošinj, Croatia)
Emir Gumrukcuoglu
Stable cosmology in massive gravity and in its extensions

2nd Mediterranean Conference on Classical and Quantum Gravity
(2013.06.09–06.15, Veli Lošinj, Croatia)
John Kehayias
Quantum Instability of the Emergent Universe

CMB2013
(2013.06.10–06.14, OIST, Okinawa, Japan)
Atsushi Nishizawa
Stacking analysis for detecting the ISW effect at the local universe

Colloquium de Mathematiques de Rennes
(2013.06.10, Rennes, France)
Toshiyuki Kobayashi
Global Geometry and Analysis on Locally Pseudo-Riemannian Homogeneous Spaces

KAIST Colloquium
(2013.06.10, Daejeon, Korea)
Hitoshi Murayama
Quantum Universe

Massive Stars: From α to Ω
(2013.06.10–06.14, Rhodes, Greece)
Melina Bersten
Progenitors of Core-Collapse Supernovae

KAIST Seminar
(2013.06.11, Daejeon, Korea)
Hitoshi Murayama
Mysteries with the number of Nambu-Goldstone bosons

Seminar at TITech
(2013.06.12, TITech)
Shinji Mukohyama
From configuration to dynamics

Subaru Ground Layer AO Science Workshop
(2013.06.13–06.14, Hokkaido U)
Malte Schramm
Studying high-redshift AGN host galaxies with Adaptive Optics

Seminar at YITP
(2013.06.13, TITP, Kyoto U)
Shinji Mukohyama
Overview of massive gravity and cosmology

The Next Decade of Weak Lensing Science
(2013.06.16–07.07, Aspen Center for Physics, USA)
Masahiro Takada
Hyper Suprime-Cam Survey

7th Crete Regional Meeting in String Theory
(2013.6.16–06.23, Orthodox Academy of Crete, Kolymbary, Greece)
Rene Meyer
A Holographic Model of the Fractional Quantum Hall Effect

X. International Workshop: Lie Theory and Its Applications in Physics (LT-10)
(2013.06.17–06.23, Varna, Bulgaria)
Toshiyuki Kobayashi
F-method to construct natural operators

Exact Results in String/M-theory
(2013.06.17–06.21, KIAS, Seoul, Korea)
Masahito Yamazaki
Gauge/YBE correspondence

KICP workshop "Galaxies within the cosmic web"
(2013.06.18, KICP, Chicago)
Surhud More
Pseudo-evolution of the halo mass-stellar mass relation

Young Mathematician Forum
(2013.06.18–06.21, BICMR, Peking U)
Yefeng Shen
Landau-Ginzburg/Calabi-Yau correspondence for elliptic orbifold P^1

Seminar at U Washington
(2013.06.18, U Washington, USA)
Mitsutoshi Fujita
Dualities from large N orbifold equivalence in Chern-Simons-matter theories with flavor

Seminar at Nagoya U
(2013.06.18, NagoyaU)
Shinji Mukohyama
Massive gravity and cosmology

Holography 2013: Gauge/gravity duality and strongly correlated systems
(2013.06.19–06.20, APCTP, Pohang, Korea)
Shigeki Sugimoto
Holographic QCD

LAL Seminar
(2013.06.19, Orsay, France)
Hitoshi Murayama
Physics at ILC and its status in Japan

Seminar at Toyama U
(2013.06.21, Toyama U)
Tatsu Takeuchi
Analytical Approximation to the Neutrino Oscillation Probabilities at large θ_{13}

Lecture at Toyama U
(2013.06.21, Toyama U)
Tatsu Takeuchi
Introduction to the Analysis of Precisions Electroweak Measurements

Seminar at Nagoya U
(2013.06.24, Nagoya U)
Tatsu Takeuchi
Analytical Approximation to the Neutrino Oscillation Probabilities at large θ_{13}

Symplectic geometry and mathematical physics, PRIMA 2013
(2013.06.24–06.28, Sanghai, China)
Todor Milanov
The Eynard-Orantin recursion in singularity theory

Lepton Photon Conference 2013
(2013.06.24–06.29, San Francisco, USA)
Mihoko Nojiri
Theoretical Results on Physics Beyond Standard Model

Lepton Photon Conference 2013
(2013.06.24–06.29, San Francisco, USA)
Hitoshi Murayama
The View Ahead

Seminar at Nagoya U
(2013.06.25, Nagoya U)
Tatsu Takeuchi
Some Mutant Forms of Quantum Mechanics

Seminar at Queen Mary U of London
(2013.06.25, Queen Mary U of London)
Shinji Mukohyama
Massive gravity and cosmology

Development of Representation Theory and its Related Fields
(2013.06.25–06.28, RIMS, Kyoto U)
Yoshiki Oshima
Restriction and cohomological induction of (g, K)-modules

Seminar at Portsmouth U
(2013.06.26, Portsmouth, UK)
Shinji Mukohyama
From configuration to dynamics

Algebraic Geometry Seminar
(2013.06.28, Kyoto U)
Charles Siegel
The Schottky Problem in genus 5

Seminar at Osaka City U
(2013.06.28, Osaka City U)
Norihiro Tanahashi
Horizon instability of an extreme Reissner-Nordstrom black hole

String Theory, Black Holes and Holography
(2013.07.01–07.05, YITP, Kyoto U)
Norihiro Tanahashi
Horizon instability of an extreme Reissner-Nordstrom black hole

New Horizons for Observational Cosmology
(2013.07.01, Enrico Fermi School, Villa Monastero, Varenna)
Marcus Werner
A new geometrical approach to void statistics

FLASY13
(2013.07.01–07.05, Niigata U)
Shigeki Matsumoto
A dark matter charged under $U(1)_{B\text{-}L}$

Journee Mathematique de la Federation de Recherche
(2013.07.02, Amiens, France)
Toshiyuki Kobayashi
Global Geometry and Analysis on Locally Pseudo-Riemannian Homogeneous Spaces

Seminar
(2013.07.08, U Tokyo, Komaba)
Richard Eager
Elliptic genera and two dimensional gauge theories

Representations of Reductive Groups
(2013.07.08–07.12, Salt Lake City, USA)
Toshiyuki Kobayashi
Multiplicities in the restriction and real spherical varieties

Cosmological Frontiers in Fundamental Physics
(2013.07.08, Perimeter Inst, Canada)
Shinji Mukohyama
Massive gravity and cosmology

Seminar at Politecnico di Bari
(2013.07.09, Politecnico di Bari, Bari)
Marcus Werner
Gravitational lensing, from topology to Finsler geometry

2013 TRIUMF summer institute
(2013.07.12, Vancouver, Canada)
Hitoshi Murayama
Outlook lecture "Mysteries of the Quantum Universe"

APPC12
(2013.07.14–07.19, Chiba, Japan)
Haruki Nishino
POLARBEAR CMB Polarization Experiment

School on the Future of Collider Physics
(2013.07.16, Kavli IPMU)
Hitoshi Murayama
Introduction to ILC

Seminar at Osaka U
(2013.07.19, Osaka, Japan)
Shigeki Sugimoto
Confinement and Dynamical Symmetry Breaking in non-SUSY Gauge Theory from S-duality in String Theory

Hayama Symposium on Complex Analysis in Several Variables XVI.
(2013.07.20–07.23, Hayama, Japan)
Toshiyuki Kobayashi
Global Geometry and Analysis on Locally Pseudo-Riemannian Homogeneous Spaces

Colloquium at Fukui U
(2013.07.22, Fukui U, Fukui, Japan)
Tatsu Takeuchi
Problems in STEM education at a US University and attempted solutions

The Triggering Mechanisms of Active Galactic Nuclei
(2013.07.22, Lorentz Center, Leiden, Netherlands)
John Silverman
A scale dependent modulation of black hole growth

Dark matter, dark energy and their detection
(2013.07.22–07.26, Novosibirsk, Russia)
Masamune Oguri
Dark matter distributions in clusters and galaxies measured using gravitational lensing

9th Marseille Cosmology Conference, "Physical Processes of Galaxy Formation: Consensus and Challenges"
(2013.07.22–07.26, Aix-en-Provence, France)
Tomoki Saito
Quantifying the environment of Lyα blob at z=4.1: On-going canibalism of dark haloes?

Mathematics Seminar
(2013.07.26, KIAS, Seoul)
Ivan Chi-Ho Ip
Positive Representations: Motivation, Construction and Perspective from C* Algebra

Ripples in the Cosmos
(2013.07.26, Durham, UK)
Hitoshi Murayama
SuMIRe / PFS

Higgs Hunting 2013
(2013.07.27, Paris, France)
Hitoshi Murayama
Future machines potentials (theory)

Gauge/Gravity Duality 2013
(2013.7.29–8.2, Max-Planck-Institute for Physics, Munich, Germany)
Rene Meyer
A Holographic Model of the Fractional Quantum Hall Effect

Hot Topics in General Relativity and Gravitation
(2013.07.30, Quy Nhon, Vietnam)
Shinji Mukohyama
From configuration to dynamics

Hot Topics in General Relativity and Gravitation
(2013.07.30, Quy Nhon, Vietnam)
Shinji Mukohyama
Massive gravity and cosmology

String Theory, Integrable Systems and Representation theory
(2013.07.30–08.02, RIMS, Kyoto U)
Ivan Chi-Ho Ip
Braiding Structure of Positive Representation of Split Real Quantum Groups

Hypergeometric functions and representation theory
(2013.08.05, Ulaanbaatar, Mongolia)
Toshiyuki Kobayashi
Analysis on minimal representations. What are minimal representations?

Summer Simons Workshop in Mathematics and Physics
(2013.08.05–08.16, Simons Center, Stony Brook, NY)
Richard Eager
Superconformal Indices, Sasaki-Einstein Manifolds, and Cyclic Homologies

Progress of Particle Physics 2013
(2013.08.09, YITP, Kyoto U)
Hitoshi Murayama
The View Ahead

CAANDY (Copenhagen-Asia-America Network for Dark cosmologY) kickoff meeting
(2013.08.13, Dark Cosmology Centre, Niels Bohr Inst)
Shinji Mukohyama
Alternative Gravity Theories @ Kavli IPMU

SI2013
(2013.08.17–08.23, Jirisan National Park, Korea)
Shigeki Matsumoto
Phenomenology of a Fermionic ADM

Susy 2013
(2013.08.26–08.31, ICTP, Trieste, Italy)
John Kehayias
No GUTs, All Glory: Charge Quantization From Nonlinear σ-Models

Japan-Netherlands Seminar
(2013.08.26–08.30, Nagoya U)
Toshiyuki Kobayashi
Global Geometry and Analysis on Locally Pseudo-Riemannian Homogeneous Spaces

SUSY 2013
(2013.08.26–08.31, ICTP, Trieste, Italy)
Satyanarayan Mukhopadhyay
Jet angular correlations in VBF topology: top and bottom quark processes as a testing ground

SUSY2013
(2013.08.26–08.31, ICTP, Trieste, Italy)
Shigeki Matsumoto
Decaying dark matter and the AMS-02 result

Asian Science Camp
(2013.08.26, KEK)
Hitoshi Murayama
Introduction to Cosmology

Conference in Honour of the 90th Birthday of Freeman Dyson
(2013.08.26–2013.08.29 , Nanyang Technological U, Singapore)
Serguey T. Petcov
Leptonic CP Violation and Leptogenesis

COSMO 2013
(2013.09.02–09.06, Centre for Theoretical Cosmology, Cambridge, UK)
Norihiro Tanahashi
Multi-field G-inflation

STFC meeting
(2013.09.03, Oxford, UK)
Hitoshi Murayama
Physics at ILC

Seminar at SISSA
(2013.09.04, SISSA, Italy)
Shigeki Matsumoto
Pure gravity mediation model and its phenomenology

ASJ annual meeting
(2013.09.10–09.12, Tohoku U)
Shun Saito
Nonlocal halo bias induced by nonlinear gravitational evolution

CMS Week 2013 in Taiwan
(2013.09.10, Taipei)
Hitoshi Murayama
God Particle, then What?

Theory seminar
(2013.09.11, UC Berkeley)
John Kehayias
No GUTs, All Glory: Charge Quantization in the CP(1) Nonlinear σ-Model

Seminar at ITP, U Heidelberg
(2013.09.12, ITP, U Heidelberg)
Masahiro Takada
Power spectrum super-sample covariance

Lunch talk at Carnegie Mellon U
(2013.09.13, Carnegie Mellon U)
Claire Lackner
Bulges and Disks: How galaxy components change with environment

Theory seminar
(2013.09.16, Columbia U)
John Kehayias
No GUTs, All Glory: Charge Quantization in the CP(1) Nonlinear σ-Model

Workshop "Holography: From Gravity to Quantum Matter"
(2013.09.16–09.20, Isaac Newton Inst, UK)
Norihiro Tanahashi
Horizon instability of an extreme Reissner-Nordstrom black hole

Chemical Evolution in the Universe
(2013.09.16–09.20, Castiglione, Italy)
Ken'ichi Nomoto
Progenitors of Supernovae

Chemical Evolution in the Universe
(2013.09.16–09.20, Castiglione, Italy)
Marco Limongi
Chemical yields of massive stars with and without rotation at various metallicities

East Asian Symplectic Conference 2013
(2013.09.18–09.21, Kagoshima)
Changzheng Li
Primitive forms and mirror symmetry

Theory seminar
(2013.09.18, Stony Brook U)
John Kehayias
No GUTs, All Glory: Charge Quantization in the CP(1) Nonlinear σ-Model

Workshop on Representations of Lie groups and their subgroups
(2013.09.19–09.20, Chalmers U / U Gothenburg)
Toshiyuki Kobayashi
Symmetry breaking for representations of rank one orthogonal groups

LC13 Workshop
(2013.09.19, Trento, Italy)
Hitoshi Murayama
The LCC project: a road to the future of High Energy Physics

Informal theory seminar
(2013.09.20, New York U)
John Kehayias
No GUTs, All Glory: Charge Quantization in the CP(1) Nonlinear σ-Model

JPS fall meeting
(2013.09.20–09.23, Kochi U, Kochi, Japan)
Haruki Nishino
Status of CMB polarization experiment POLARBEAR

JPS fall meeting
(2013.09.20–09.23, Kochi U, Kochi, Japan)
Shigeki Matsumoto
Constraints on WIMP dark matter from collider experiments

JPS fall meeting
(2013.09.20–09.23, Kochi U, Kochi, Japan)
Hitoshi Murayama
Roadmap to realize ILC

Observational Signatures of Type Ia Supernova Progenitors II
(2013.09.23–09.27, Leiden, Netherland)
Ken'ichi Nomoto
Final Evolution of Rotating White Dwarfs in Single Degenerate Scenario

Seminar on Pure Mathematics
(2013.09.24–09.27, The Hong Kong U of S&T)
Yefeng Shen
LG-LG mirror symmetry

Theory seminar
(2013.09.27, UC Irvine)
John Kehayias
No GUTs, All Glory: Charge Quantization in the CP(1) Nonlinear σ-Model

SRF2013
(2013.09.27, Paris, France)
Hitoshi Murayama
Pathways to an Higgs Factory

workshop on the galaxy bias
(2013.10.01, Trieste, Italy)
Brice Menard
Introducing clustering redshifts

Informal lunch talk
(2013.10.02, UC Santa Cruz)
John Kehayias
No GUTs, All Glory: Charge Quantization in the CP(1) Nonlinear σ-Model

Seminar at Osservatorio Astronomico di Trieste
(2013.10.04, Osservatorio Astronomico di Trieste)
Shun Saito
Modeling and measuring the large-scale galaxy clustering in redshift space

Hong Kong Geometry Colloquium
(2013.10.05, The Hong Kong U of S&T)
Yefeng Shen
Mirror symmetry for exceptional unimodular singularities

Workshop on Galaxy Bias: Non-linear, Non-local and Non-Gaussian
(2013.10.08–10.11, ITCP, Trieste, Italy)
Shun Saito
Understanding non-local halo bias combining the power spectrum and the bispectrum

Oliver Club Lecture
(2013.10.10, Cornell, USA)
Toshiyuki Kobayashi
"Universal Sounds" of Anti-de Sitter Manifolds

IAS Seminar
(2013.10.10, IAS, Princeton)
Hitoshi Murayama
What's wrong with Goldstone?

Sophus Lie Days
(2013.10.11, Cornell U)
Toshiyuki Kobayashi
Global Geometry and Analysis on Locally pseudo-Riemannian Symmetric Spaces

MIT Seminar
(2013.10.11, MIT, Boston)
Hitoshi Murayama
Generalization of Goldstone's Theorem Without Lorentz Invariance

The Return of de Sitter II
(2013.10.14–10.18, MPA, Garching, Germany)
Masahiro Takada
Subaru Measurements of Images and Redshifts (SuMIRe) project: HSC and PFS (invited talk)

ICTS cosmology seminar
(2013.10.15, ICTS, Bangalore)
Surhud More,
Cosmological constraints from galaxy surveys

Seminar at Nagoya U
(2013.10.16, Nagoya U)
Claire Lackner
Bulges and Disks: How galaxy components change with environment

GR Seminar at DAMTP
(2013.10.18, DAMTP, Cambridge U, UK)
Norihiro Tanahashi
Dynamical Phenomena in Holographic Meson Melting

GR seminar at DAMTP
(2013.10.18, DAMTP, U Cambridge, UK)
Norihiro Tanahashi
Dynamical Phenomena in Holographic Meson Melting

Particle Physics and Cosmology Beyond the Higgs Boson
(2013.10.22, Tohoku U)
Shinji Mukohyama
Massive gravity and cosmology

HEP Seminar
(2013.10.25, Harish-Chandra Research Inst, Allahabad, India)
Satyanarayan Mukhopadhyay
Light Dark Matter: Two Possibilities

Supernovae and Gamma-Ray Bursts
(2013.10.28–11.01, YITP, Kyoto U)
Keiichi Maeda
Supernovae in Optical and Beyond

Supernovae and Gamma-Ray Bursts
(2013.10.28–11.01, YITP, Kyoto U)
Ken'ichi Nomoto
Evolution and Final Fates of Accreting White Dwarfs

OIST Colloquium
(2013.11.01, OIST, Okinawa)
Hitoshi Murayama
THE QUANTUM UNIVERSE

Supernovae and Gamma-Ray Bursts
(2013.11.1–11.15, Kyoto)
Marco Limongi
Presupernova evolution, explosion and nucleosynthesis of rotating massive stars

JSPS-DST Asian Academic Seminar 2013: Discrete Mathematics & its Applications
(2013.11.03–11.10, U Tokyo)
Toshiyuki Kobayashi
Global Geometry and Analysis on Locally Pseudo-Riemannian Homogeneous Spaces

5th PFS General Collaboration Meeting
(2013.11.04, Sao Paul sao Paulo, Brazil)
Hitoshi Murayama
PFS collaboration-high level overview

The 23rd Workshop on General Relativity and Gravitation in Japan
(2013.11.05–11.08, Hirosaki, Aomori)
Ryo Namba
Gauge-flation Confronted with CMB Observations

TIFR cosmology seminar
(2013.11.06, TIFR, Mumbai)
Surhud More
Cosmological constraints from galaxy surveys

TIFR cosmology seminar
(2013.11.07, TIFR, Mumbai)
Surhud More
The weak lensing and clustering of SDSS III galaxies: from astrophysics to cosmology

Colloquium of Physics Department, U Sao Paulo
(2013.11.07, U Sao Paulo, Brazil)
Masahiro Takada
Colloquium: "Progresses and prospects of observational cosmology: SuMIRe project"

Theory seminar
(2013.11.07, U Tokyo, Komaba)
John Kehayias
No GUTs, All Glory: Charge Quantization in the CP(1) Nonlinear σ-Model

Inter-Academy Seoul Science Forum
(2013.11.11, Seoul, Korea)
Serguey T. Petcov
Prospects of Neutrino Physics (invited talk)

The 3rd KIAS Workshop on Particle Physics and Cosmology
(2013.11.11–11.15, KIAS, Korea)
Shigeki Matsumoto
Revisiting Wino Dark Matter

Theory Seminar
(2013.11.14, IACS, Kolkata, India)
Satyanarayan Mukhopadhyay
Light Dark Matter: Two Possibilities

Hiroshima Topology Conference "Four Dimensional Topology"
(2013.11.15–11.17 , Hiroshima U)
Tirasan Khandhawit
Manolescu-Floer spectra for Seiberg-Witten monopoles

Seminar at YITP
(2013.11.15, YITP, Kyoto U)
Mitsutoshi Fujita
From Maxwell-Chern-SImons theory in AdS_3 black hole towards hydrodynamics in 1+1 dimensions

The joint Particle Theory and Quantum Gravity seminar series at U Nottingham
(2013.11.15, U Nottingham, UK)
Norihiro Tanahashi
Multi-field G-inflation

An intensive course of lectures
(2013.11.15, Tohoku U)
Masahiro Takada
An intensive course of lectures "Cosmology"

Seminar at RIKEN
(2013.11.18, RIKEN)
Marcus Werner
Mathematical Properties of Gravitational Lensing Theory

The 12th international symposium on Origin of Matter and Evolution of Galaxies (OMEG12)
(2013.11.18–11.21, Tsukuba)
Ken'ichi Nomoto
Electron-capture supernovae of super-asymptotic giant branch stars and the Crab supernova 1054

PASCOS (the 19th International Symposium on Particles, Strings and Cosmology)
(2013.11.20–11.26, National Taiwan U, Taipei, Taiwan)
Masahiro Takada
Power spectrum super-sample covariance (invited talk)

PASCOS (the 19th International Symposium on Particles, Strings and Cosmology)
(2013.11.20–11.26, National Taiwan U, Taipei, Taiwan)
Shun Saito
Beyond Baryon Acoustic Oscillations in the BOSS CMASS galaxy clustering

PASCOS (the 19th International Symposium on Particles, Strings and Cosmology)
(2013.11.20–11.26, National Taiwan U, Taipei, Taiwan)
Mihoko Nojiri
Physics opportunity at future colliders

Infinite Analysis 13 Autumn School
(2013.11.20–11.22, Osaka City U)
Ivan Ip
Positive Representations: Motivation, Construction and Braiding Structure

PASCOS (the 19th International Symposium on Particles, Strings and Cosmology)
(2013.11.20–11.26, National Taiwan U, Taiwan, Taipei)
Yue-Lin Sming Tsai
An updated analysis of inert Higgs doublet model in light of LUX, PLANCK, AMS-02 and LHC

Seminar at Kobe U
(2013.11.26, Kobe U)
Shinji Mukohyama
Horava-Lifshitz gravity with extra U(1) symmetry

Invitation to the workshop "SUSY: Model-building and Phenomenology"
(2013.12.02, Kavli IPMU)
Hitoshi Murayama
Is there Life after Higgs?

INT Workshop INT-13-54W: Neutrino-Nucleus Interactions for Current and Next Generation Neutrino Oscillation Experiments
(2013.12.03–12.13, U Washington, Seattle, USA)
Mark Hartz
Effect of Multinucleon Processes in the T2K Oscillation Analysis

The 2nd workshop "Observational cosmology"
(2013.12.04–12.06, NAOJ)
Shun Saito
Galaxy Power Spectrum in the BOSS CMASS catalog

Seminar at IPhT in Saclay
(2013.12.04, Saclay, France)
Shinji Mukohyama
Massive gravity and cosmology

2nd workshop "Observational cosmology"
(2013.12.04–12.06 NAOJ)
Nobuhiro Okabe
Cluster mass measurement using weak gravitational lensing effect (invited)

iTHES Colloquium
(2013.12.04, RIKEN, Japan)
Hitoshi Murayama
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Seminar at NCTS
(2013.12.05, NCTS, National Tsing Hua U)
Yue-Lin Sming Tsai
p9MSSM Neutralino Dark Matter signature

Seminar at ICTS, Bangalore
(2013.12.05, India)
Anupreeta More
Strong gravitational lenses from large galaxy surveys

Algebra/Geometry/Topology Seminar
(2013.12.06, U Melbourne)
Ivan Ip
Positive Representations of Split Real Quantum Groups

Theory seminar
(2013.12.06, Perimeter Inst)
John Kehayias
No GUTs, All Glory: Charge Quantization in the CP(1) Nonlinear σ-Model

UCL Seminar
(2013.12.06, U College London, UK)
Hitoshi Murayama
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150 years of UK-Japan collaboration Science, Technology and Innovation Symposium–Astronomy & Space Science
(2013.12.06, London, UK)
Hitoshi Murayama
What is dark matter

150 years of UK-Japan collaboration Science, Technology and Innovation Symposium–Astronomy & Space Science
(2013.12.06, London, UK)
Andrew Bunker
The First Billion Years of History–Finding the most distant galaxies with the largest telescopes

The 27th Texas Symposium on Relativistic Astrophysics
(2013.12.08–12.13, Dallas, Texas, USA)
Ryo Namba
Gauge-flation confronted with CMB observations

Topological Methods in Nonlinear Analysis Seminar
(2013.12.10, Gdansk U of Technology, Poland)
Tirasan Khandhawit
Stable Conley index on Hilbert spaces

Seminar at APC in Paris
(2013.12.10, Paris, France)
Shinji Mukohyama
Horava-Lifshitz gravity with extra U(1) symmetry

Seminar at APC in Paris
(2013.12.10, Paris, France)
Shinji Mukohyama
Massive gravity and cosmology

TH Theoretical Seminar
(2013.12.11, Geneva, Switzerland)
Hitoshi Murayama
What's New with Goldstone?

Topological Methods in Nonlinear Analysis Seminar
(2013.12.11–12.12, Gdansk U of Technology, Poland)
Tirasan Khandhawit
Stable homotopy type for monopole Floer homology

Gravity Seminar Series at U Southampton
(2013.12.12, U Southampton, UK)
Norihiro Tanahashi
Horizon instability of an extreme Reissner-Nordstrom black hole

6th Workshop on String Theory
(2013.12.12–12.15, National Taiwan U, Taipei, Taiwan)
Rene Meyer
A Holographic Model of the Fractional Quantum Hall Effect

Seminar at YITP
(2013.12.17, YITP, Kyoto U)
Shun Saito
Precise measurement of cosmic expansion history and growth of the large-scale structure from the updated BOSS CMASS galaxy clustering

Series of Lectures at Tohoku U
(2013.12.17–12.19, Tohoku U)
Shigeki Matsumoto
Dark Matter Phenomenology

Workshop on Modified Gravity
(2013.12.17, YITP, Kyoto U)
Shinji Mukohyama
A no-go theorem for generalized vector Galileons on flat spacetime

Seminar at Nagoya U
(2013.12.19, Nagoya U)
Shun Saito
Precise measurement of cosmic expansion history and growth of the large-scale structure from the updated BOSS CMASS galaxy clustering

Seminar at Tohoku U
(2013.12.19, Tohoku U)
Shigeki Matsumoto
Non-WIMP dark matter candidates

News in Neutrino Physics Workshop
(2013.12.20, Inst of Physics, London, UK)
Serguey T. Petcov
Theory Prospective on Neutrino Masses (invited talk)

National Strings Meeting (India)-2013
(2013.12.22–12.27, IIT Kharagpur, India)
Jyotirmoy Bhattacharya
Entropic counterpart of perturbative Einstein equations

Tuesday Seminar on Topology
(2013.12.24, U Tokyo, Komaba)
Tirasan Khandhawit
Stable homotopy type for monopole Floer homology

International conference on algebraic geometry and symplectic geometry
(2013.12.27–12.29, U of S&T of China)
Changzheng Li
Primitive forms and mirror symmetry

AG Seminar
(2013.12.27, AG laboratory, HSE, Moscow)
Ilya Karzhemanov
On characterization of toric varieties

Rironkon Symposium: Theoretical Astrophysics and Astronomy for 2020ies
(2013.12.27, Kavli IPMU)
Hitoshi Murayama
Particle physics theory

Astro-H workshop
(2013.12.28, Tokyo U of Science)
Masahiro Takada
Subaru Hyper Suprime-Cam Survey (invited)

Workshop of "physics of galaxy clusters"
(2013.12.28, Tokyo U of Science)
Nobuhiro Okabe
Synergy with HSC survey and mutli-wavelength projects (invited)

Calabi-Yau Geometry and Mirror Symmetry conference
(2014.01.06–01.10, National Taiwan U)
Changzheng Li
Primitive forms and mirror symmetry

Seminar at Particle Physics Theory Group
(2014.01.07, Osaka U)
Masahiro Takada
The large-scale structure of the Universe: the current status and future prospects

Integrability, Symmetry and Quantum Space-Time
(2014.01.07–01.09, YITP, Kyoto U)
Richard Eager
Supersymmetric localization and elliptic genera

Meeting of the Int. Committee for Future Accelerators–Neutrino Panel
(2014.01.08, APC, Paris, France)
Serguey T. Petcov
Leptonic CP Violation and Leptogenesis (invited talk)

Astronomy Tea Talk at Caltech
(2014.01.13, Caltech)
Andreas Schulze
The cosmic growth of the active black hole population

"NuDay" Workshop
(2014.01.14, U Warsaw, Poland)
Serguey T. Petcov
Neutrino Masses, Mixing and Oscillations: Current Status and Future Prospects (invited lecture)

The 27th workshop on cosmic neutrinos: absolute mass scale of neutrinos in cosmological observations and laboratory experiments
(2014.01.20, ICRR, U Tokyo)
Shun Saito
Cosmological constraint on neutrino properties I: Cosmic Microwave Background (invited talk)

The 27th workshop on cosmic neutrinos: absolute mass scale of neutrinos in cosmological observations and laboratory experiments
(2014.01.20, ICRR, U Tokyo)
Shun Saito
Cosmological constraint on neutrino properties II: Large-Scale Structure (invited talk)

UK Cosmology meeting
(2014.01.20, King's College London, UK)
Norihiro Tanahashi
Multi-field G-inflation

The 27th workshop on cosmic neutrinos
(2014.01.20, ICRR, U Tokyo)
Haruki Nishino
First Results from POLARBEAR

Representation Theory and Analysis of Reductive Groups: Spherical Spaces and Hecke Algebras
(2014.01.21–01.25, Oberwolfach, Germany)
Toshiyuki Kobayashi
Shintani functions, real spherical manifolds, and symmetry breaking operators

Subaru Users' Meeting FY2013
(2014.01.21–01.23, NAOJ)
Nobuhiro Okabe
Subaru Weak-lensing Results of Galaxy Clusters

Seminar at Seikei U
(2014.01.21, Seikei U, Tokyo)
Shigeki Sugimoto
Confinement and String Theory

Subaru Users Meeting 2013
(2014.01.21–01.23, NAOJ)
Keiichi Maeda
Supernova Follow-up Observations with Subaru and Other 8m-class Telescopes

The International Workshop on Prospects of Particle Physics: "Neutrino Physics and Astrophysics"
(2014.01.26–02.02, Valday, Russia)
Alexandre Kozlov
Status of the KamLAND physics program

The Joint Los Angeles Topology Seminar
(2014.01.27, UCLA)
Tirasan Khandhawit
Stable homotopy type for monopole Floer homology

An intensive course of lectures
(2014.02.03–02.05, Nagoya U)
Masahiro Takada
An intensive course of lectures "Cosmology: Structure Formation"

Seminar at U of Victoria
(2014.02.03, U Victoria, BC, Canada)
Mitsutoshi Fujita
From Maxwell-Chern-Simons theory in AdS3 towards hydrodynamics in 1 + 1 dimensions

Colloquium at Nagoya U
(2014.02.04, Nagoya U)
Masahiro Takada
Large-scale structure: current status and challenges

International Conference on Flavor Physics and Mass Generation
(2014.02.05, IAS, Nanyang Technological U, Singapore)
Serguey T. Petcov
Predictions for the Leptonic Dirac CP Violation Phase (invited talk)

APC-YITP collaboration: mini-workshop on gravitation and cosmology
(2014.02.07, YITP, Kyoto U)
Shinji Mukohyama
Updates on Horava-Lifshitz gravity

Matsue Pheno. Workshop
(2014.02.08–02.09, Matsue, Shimane, Japan)
Shigeki Matsumoto
Non-WIMP dark amtter candidates

Conference on the occasion of Professor Matsuki's 60th birthday
(2014.02.08–02.09, Tottori, Japan)
Toshiyuki Kobayashi
Real Spherical Manifolds, and Symmetry Breaking Operators

Primitive forms and related subjects
(2014.02.10–02.14, Kavli IPMU)
Todor Milanov
The phase form in singularity theory

IAS Type Ia Supernova Workshop
(2014.02.10–02.12, IAS, Princeton)
Keiichi Maeda
Nebular Line Diagnostics on SN Ia Explosion Mechanism

Type Ia Supernovae Workshop
(2014.02.10–02.12, IAS, Princeton)
Ken'ichi Nomoto
Progenitors of Type Ia supernovae

Basis of the Universe with Revolutionary Ideas 2014
(2014.02.13–02.14, U Toyama, Japan)
Shigeki Matsumoto
Wino dark matter breaks the siege

Winter School on Representation Theory of Real Reductive Groups
(2014.02.15, U Tokyo)
Toshiyuki Kobayashi
Real spherical manifolds, symmetry breaking operators, and Shintani functions

The Impact of Galactic Structure on Star Formation
(2014.02.16–02.21, Hokkadio U)
Claire Lackner
Bulges and discs: how galaxy components change with local environment

RESCEU Seminar
(2014.02.17, U Tokyo)
Ryo Namba
Footprints of interactions during primordial inflation in gravitational-wave signals

KEK Theory Workshop
(2014.2.18–2.21, KEK)
Rene Meyer
A Holographic Model for the Fractional Quantum Hall Effect

Geometry and Physics of F-theory
(2014.02.24–2014.02.27, IWH, U Heidelberg)
Taizan Watari
Noether-Lefschetz problem and gauge-group-resolved landscape

Mini-workshop on “Cosmology with redshift-space galaxy clustering”
(2014.02.25–02.26, YITP, Kyoto U)
Shun Saito
Implication of the latest BOSS RSD results and discrepancy with Planck

Seminar at Kinki U
(2014.02.26, Kinki U, Osaka)
Shinji Mukohyama
Updates on Horava-Lifshitz gravity

Seminar at Tsukuba U
(2014.02.28, Tsukuba U)
Shinji Mukohyama
Massive gravity and cosmology

B-model aspects of Gromov-Witten theory
(2014.03.03–03.07, U Michigan, Ann Arbor)
Todor Milanov
Gromov-Witten theory of Fano orbifold curves and ADE-Toda hierarchies

B-model aspects of Gromov-Witten Theory
(2014.03.03–03.07, U Michigan, Ann Arbor)
Yefeng Shen
Global mirror symmetry for invertible simple elliptic singularities

Pedagogical workshop on B-model
(2014.03.10–03.14, U Michigan, Ann Arbor)
Todor Milanov
Analyticity of the total ancestor potential in singularity theory

KEK theory Seminar
(2014.03.12, KEK)
Jonathan Maltz
Gauge Invariant Computable Quantities In Timelike Liouville Theory

Royal Astronomical Society meeting: Supernovae in near and far
(2014.03.14, London, UK)
Chiaki Kobayashi
The role of supernovae on chemical evolution of galaxies

Infinite analysis and integrable systems–JMS meeting
(2014.03.17–03.18, Gakushuin U, Tokyo)
Todor Milanov
Hirota quadratic equations in singularity theory

Theoretical cosmology meeting at ICG, U Portsmouth
(2014.03.19, ICG, U Portsmouth)
Norihiro Tanahashi
Horndeski Theory and its Multi-field extension

The Astronomical Society of Japan, Annual Meeting 2014 Spring
(2014.03.19–03.22, Int. Christian U, Mitaka, Japan)
Miho Ishigaki
Europium composition of the Galactic stellar halo and the thick disk

Neutron Stars
(2014.03.24–03.28, Florence, Italy)
Ken’ichi Nomoto
Supernova Explosions of Super-AGB Stars

ATLAS workshop
(2014.03.25–03.26, U Tokyo)
Shigeki Matsumoto
High-scale SUSY breaking scenario

JPS conference
(2014.03.27–03.30, Toukai U, Japan)
Shigeki Matsumoto
High-scale SUSY breaking models in light of the BICEP result

JPS conference
(2014.03.27–03.30, Toukai U, Japan)
Lluis Marti-Magro
Cross comparison analyses for the new HV system at Super-Kamiokande

Theory Seminar
(2014.03.27, U Minnestoa)
John Kehayias
Charge Quantization and the Standard Model from Nonlinear Sigma Models

13 Outreach and Public Relations

The Kavli IPMU continues to convey the importance and pleasure of our research on physics and mathematics of the universe to the general public through a variety of outreach programs.

In particular, the Kavli IPMU and the Institute for Cosmic Ray Research (ICRR) of the University of Tokyo jointly organize public lectures twice a year. Also, the Kavli IPMU and the Tamarokuto Science Center organize science café annually. In FY 2013, the Kavli IPMU hosted or co-hosted various educational outreach programs, or participated science events, as listed below.

April	The 8th ICRR-Kavli IPMU Joint Public Lecture
June	The 1st and 2nd Science Café 2013 at Tamarokuto Science Center
July	The 3rd Science Café 2013 at Tamarokuto Science Center
August	Super Science High School Students Fair 2013
October	Open House at Kashiwa Campus
November	Science Agora 2013 / The 9th Workshop to Aim at Spreading Astronomy / Special Public Lecture by Fabiola Gianotti
December	The 9th Kavli IPMU-ICRR Joint Public Lecture / WPI Joint Symposium / Science Camp 2013
January	Special Public Lecture by Lisa Randall
February	2014 AAAS Annual meeting / FIRST EXPO 2014
March	Science Program for Female High-School Students

In addition, the Kavli IPMU released five new video clips of “Ask a Scientist” series on its website, each explaining a specific terminology in physics, astronomy, and mathematics, in about a minute, and published No. 21 – No. 24 of its quarterly public relations magazine, *Kavli IPMU News*.

The 8th ICRR-Kvavli IPMU Joint Public Lecture

Mihoko Nojiri, giving a lecture

On April 13, the 8th Joint ICRR-Kavli IPMU Public Lecture entitled “Decoding the Universe: Cosmic History × Elementary Particles” was held at the Amuser Kashiwa in Kashiwa City.

Professor Takaaki Kajita, Director of ICRR and a Kavli IPMU Principal Investigator, gave the opening address. ICRR Associate Professor Masami Ouchi gave the first lecture on “Approaching the Cosmic History by Means of the Deepest Field Observation.” Professor of the High Energy Accelerator Research Organization (KEK) Mihoko Nojiri, who is also a Principal Investigator of the Kavli IPMU, gave the second lecture entitled “What Can Be Understood and What Cannot Be Understood from the Discovery of the Higgs Boson.”

Science Café 2013

The Science Café 2013 “Approaching the Mystery of the Universe with Mathematics and Physics,” fifth in the series, was held at the Tamarokuto Science Center (TSC) in Nishitokyo City, jointly sponsored by the Kavli IPMU and TSC.

On June 15, Tetsuo Hatsuda, Chief Scientist at RIKEN and Visiting Senior Scientist at Kavli IPMU, gave the first lecture, “Structure of Matter: The World of Quarks.” Dr. Hatsuda explained the Standard Model of particle physics using colored balls that represent quarks. A video of the lecture is open to the public on the web site of the Japan Science and Technology Agency (JST) at http://sc-smn.jst.go.jp/playprg/index/M130011063.

Tetsuo Hatsuda, giving a lecture

Yukinobu Toda, giving a lecture

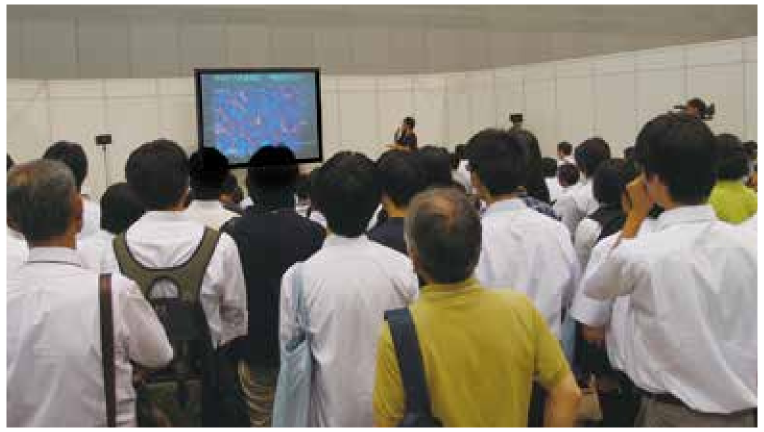
Keiichi Maeda, responding to a question

On June 22, Associate Professor Yukinobu Toda, a mathematician at Kavli IPMU, delivered the second lecture entitled “Geometry and Symmetry of the Universe.” Dr. Toda conveyed how the research at the Kavli IPMU is conducted through the cooperation of mathematicians and physicists aiming to elucidate the mystery of the universe.

On July 6, the day before the Star Festival “Tanabata,” one of the Kavli IPMU’s astronomers, Associate Professor Keiichi Maeda, gave a talk on “Supernovae —Gigantic Explosion Connecting Stellar Evolution and Cosmological Evolution” at the TSC’s planetarium dome, known as the “Science Egg.” Maeda explained the important role of supernova explosions in the history of the universe, with impressive cosmic images projected onto the planetarium dome.

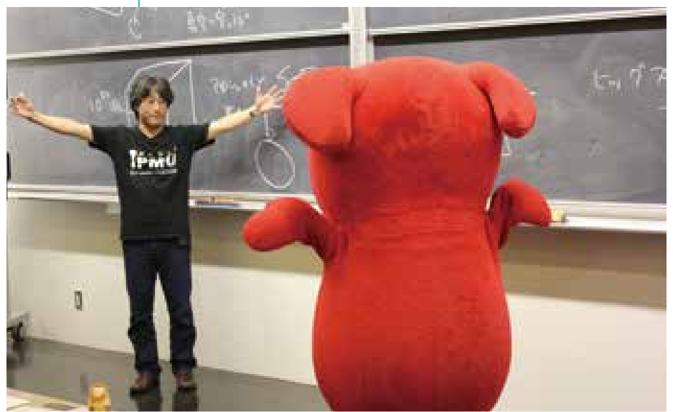
SSH Students Fair 2013

The Kavli IPMU ran a booth, exhibiting its research activities, at the Super Science High School Students Fair 2013 held at Pacifico Yokohama on August 7 and 8. Also, two young researchers working on the SuMIRe Project, Kavli IPMU Assistant Professor Masamune Oguri and Postdoctral Fellow Jun Nishizawa, jointly presented a mini lecture entitled "Dark Universe 'Seen' with the Subaru Telescope" on the second day. The mini lecture was well attended by as many as 230 students, with many of them standing. There were questions from the audience on many topics, including the future prospects of research using the Subaru Telescope and HSC, the lecturers' motivations for becoming researchers, and their high school days.



Jun Nishizawa, giving a mini lecture to an over-capacity audience

Open House at Kashiwa Campus



Hitoshi Murayama, teaching *Chiba-kun* about the Universe

An open house on the Kashiwa campus of the University of Tokyo was held on October 25. Though a two-day open house was planned, the second day was cancelled because of an approaching typhoon. Even so, the Kavli IPMU's program attracted a lot of visitors. Director Murayama presented "Ask a Scientist Live! Special," where a mascot character of Chiba Prefecture, *Chiba-kun*, made a surprise appearance.

Another "Ask a Scientist Live!" session presented by Professor Shigeki Sugimoto and a "Digital Space Theater" program attracted audiences. Graduate students explained a variety of research programs at the Kavli IPMU using posters and video clips. They also helped visitors in an experimental program of making a spectrograph by hand. A Japanese *Kyogen* performance by Kavli IPMU foreign researchers got applause from the capacity audience in the Kavli IPMU Lecture Hall.

Japanese *Kyogen* performance
by Kavli IPMU foreign researchers

Graduate students were explaining
the Kavli IPMU research programs

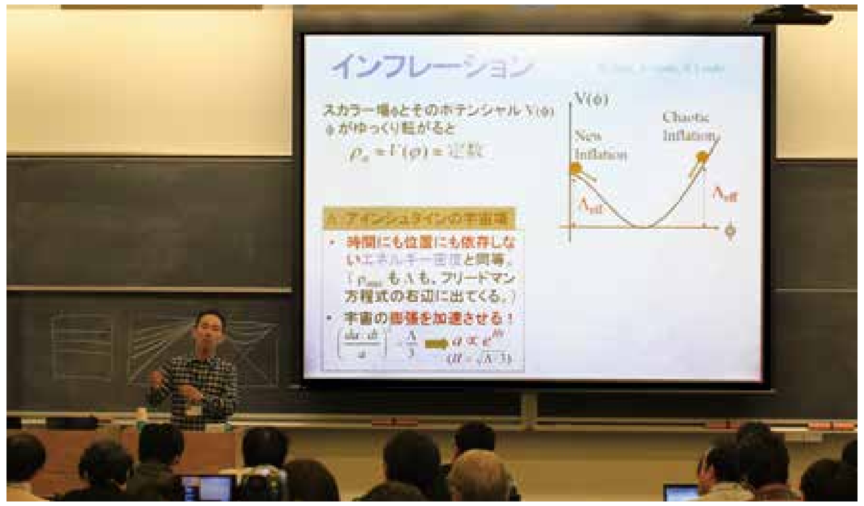
Science Agora 2013

Science Agora 2013 was held on November 9 and 10 at the National Museum of Emerging Science and Innovation (Miraikan) in the Tokyo waterfront region and all nine WPI centers participated jointly. More than 6,000 people visited the two-day event. At the "WPI Science Live!" booth where all the WPI centers presented their scientific activities in rotation, the Kavli IPMU presented a lecture by Associate Director Nobu Katayama and a talk session by two Assistant Professors in mathematics, Satoshi Kondo and Tomoyuki Abe. This "WPI Science Live!" booth was selected as one of 11 programs that received the Science Agora Award.

Satoshi Kondo, giving a "WPI Science Live!" talk

Workshop to Aim at Spreading Astronomy

"The 9th Workshop to Aim at Spreading Astronomy" was held at the Kavli IPMU lecture hall on November 17–19, co-hosted by the Kavli IPMU and the National Astronomical Observatory of Japan (NAOJ). This workshop has been held annually by NAOJ and partner institutions for those who are involved in spreading astronomy at science museums, planetariums, and educational institutions. This year, a three-day intensive course was given to the participant aiming at conveying the latest cosmology research to the many people through them. Professor Masahiro Takada served as a coordinator and also gave a lecture. Lectures were also given by Principal Investigators Naoshi Sugiyama and Mihoko Nojiri, Associate Professor Shinji Mukohyama, Director of the Department of Phyrical Cosmology, Max Planck Institute for Astrophysics Eiichiro Komatsu, Professor Naoki Yoshida at the School of Science, the University of Tokyo, and Associate Professor Keiichi Maeda at Kyoto University.



Shinji Mukohyama, giving a lecture

Special Public Lecture by Fabiola Gianotti

Dr. Fabiola Gianotti, former spokesperson of the ATLAS experiment that discovered the Higgs boson at CERN, gave a special public lecture entitled “Higgs Boson and Our Life” at the Hama-Rikyu Asahi Hall on November 20. It was hosted by the Kavli IPMU and co-hosted by the Asahi Shimbun Company. This lecture received much interest because of the announcement in the previous month that the 2013 Nobel Prize in Physics would be awarded to theorists who predicted the Higgs boson. The lecture was also broadcast live with a worldwide audience of nearly 1,000. Fabiola gave her talk in English and it was translated to Japanese by Kavli IPMU Director Hitoshi Murayama at short intervals. Mariko Takahashi, Senior Staff Writer of the Asahi Shimbun Company, moderated the Q&A session. Her frank questions highlighted Fabiola’s personality and pleased the audience very much.

Hitoshi Murayama, Fabiola Gianotti, and Mariko Takahashi in the Q&A session

The 9th Kavli IPMU-ICRR Joint Public Lecture

On December 1, the 9th Kavli IPMU-ICRR Joint Public Lecture was held at the Koshiba Hall on the University of Tokyo’s Hongo Campus. ICRR Associate Professor Masahiro Ibe, who is also a Kavli IPMU Scientist, gave the first lecture on “The Standard Model of Elementary Particles and the Higgs Boson.” The second lecture was “Evolution of the Universe Probed by Means of Supernovae” by Ken’ichi Nomoto, a Principal Investigator of the Kavli IPMU. The lecturers nicely responded to the questions from many people surrounding them at a science café-style discussion time after the lectures.

Ken’ichi Nomoto, responding to the questions from the audience

WPI Joint Symposium

On December 14, the Third Joint Symposium of the WPI centers entitled “Science Talk Live!” was held at the Sendai International Center with participation of all the nine WPI centers. About 600 high school students were invited from various places in the Tohoku region. Researchers at Tohoku University’s AIMR (The Advanced Institute for Materials Research) and Directors of three new WPI centers, launched in 2012, gave lectures. In addition, all nine WPI centers ran booths. At the Kavli IPMU booth, Director Murayama’s video clip about the discovery of the Higgs boson was shown and Kavli IPMU’s research programs were showcased using posters and a demonstration using hand-made spectrographs.

Kavli IPMU booth. Students were experiencing hand-made spectrographs

Science Camp for High School Students

A winter science camp for high school students, “Open the Door to the Universe,” was held at the Kavli IPMU for three days, December 25–27. Twenty students selected among applicants from all over Japan took part. The science camp is one of the projects supported by the Japan Science and Technology Agency (JST), providing hands-on experience to high school students. This was the third science camp held at the Kavli IPMU. The participating high school students heard lectures from Kavli IPMU Professor Shigeki Sugimoto and other researchers on forefront topics in theoretical and experimental physics and in mathematics. They also attended Kavli IPMU’s teatime at 3 p.m. every day. They actively asked foreign researchers many questions in English. A closing ceremony was held on the last day, with Kavli IPMU Director Murayama and other researchers in attendance.

High school student, discussing with Kavli IPMU researchers

Special Public Lecture by Lisa Randall

Lisa Randall and Hitoshi Murayama in the Q&A session after the lecture

On January 25, the Kavli IPMU hosted another special lecture, "Knocking on Heaven's Door," delivered by a theoretical physicist Lisa Randall, Professor at Harvard University. She talked about the Higgs boson discovery at the CERN's Large Hadron Collider (LHC) experiments from the viewpoint of a theoretical physicist. She also discussed topics ranging from the vast Universe to the tiny elementary particles it contains, and their relations. Kavli IPMU Director Hitoshi Murayama interpreted this talk at short intervals, with supplementary explanation. As Professor Randall is popular for her books for general audiences, the venue, Koshiba Hall on the University of Tokyo's Hongo campus, was full to capacity.

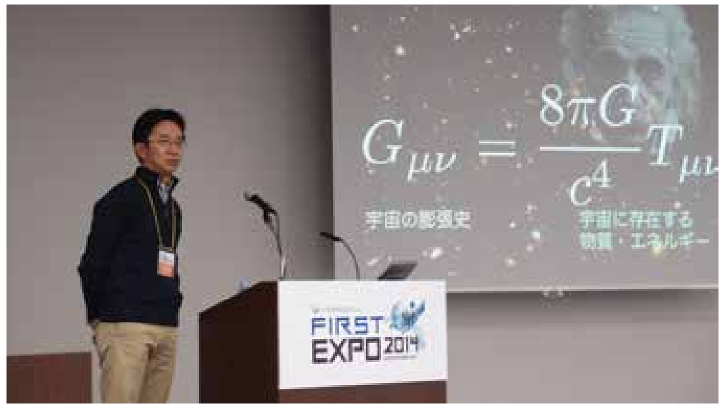
AAAS 2014 in Chicago

The nine WPI institutes jointly participated in the 2014 AAAS (American Association for the Advancement of Science) Annual meeting, held on February 13–17 at the Hyatt Regency Chicago with the theme "Meeting Global Challenges: Discovery and Innovation." The nine WPI institutes hosted the WPI booth as a part of the Japan pavilion organized by Japan Science and Technology Agency (JST), and held a one-hour workshop entitled "Build a Career in Japan!" jointly with RIKEN. In this workshop, Hideki Iwabuchi, Director of Office for the Promotion of Basic Research, Basic Research Promotion Division, Research Promotion Bureau, MEXT, introduced the WPI program, and Professor Petros Sofronis, Director of the International Institute for Carbon-Neutral Energy Research (I^2CNER), explained advanced and global research activities at the WPI institutes.

WPI booth in Japan pavilion at AAAS 2014

FIRST EXPO 2014

On February 28 and March 1, FIRST EXPO 2014 was held at Bellesalle Shinjuku Grand in Tokyo to present the outcomes of the FIRST (Funding Program for World-Leading Innovation R&D on Science and Technology) to the general public at the end of the last year of the program. Kavli IPMU's Director Hitoshi Murayama's SuMIRe (Subaru Measurement of Images and Redshifts) project is one of the 30 selected projects in the FIRST program. From this SuMIRe project, a full-scale replica of the aspherical lens used in the Hyper Suprime-Cam (HSC), an ultra-wide field digital camera, was on display. In addition, Kavli IPMU Professor Masahiro Takada talked to the public on the present status and the expected outcome of the SuMIRe project on February 28.



Masahiro Takada, giving a lecture

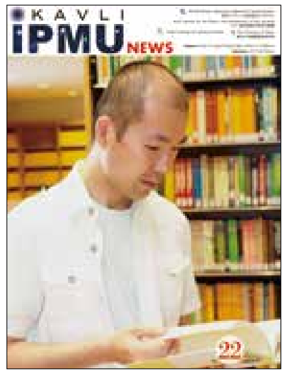
Science Program for Female High-School Students

On March 15, a program to encourage female students to study science, "Come Over to Learn the Universe!" was held at the Kavli IPMU, jointly hosted by the Kavli IPMU and the Institute for Cosmic Ray Research (ICRR), the University of Tokyo, and 35 high school and junior high school female students participated. This is a part of an attempt, planned by the University of Tokyo and supported by the Japan Science and Technology Agency (JST), to encourage female students to pursue careers in science by inspiring their interests in the field of science. The students listened to lectures given by two female researchers, Miho Ishigaki (JSPS Postdoctoral Fellow at the Kavli IPMU) and Rieko Momose (Project Researcher at ICRR), about their respective researches, and practiced laser interferometry, which is used in gravitational wave telescopes, under the guidance of graduate students. Then the students had friendly talks with the lecturers and graduate students at the Kavli IPMU's interaction area.

Students talking with lecturers and teaching assistants

Kavli IPMU News

Four issues of the Kavli IPMU News have been published in FY 2013.

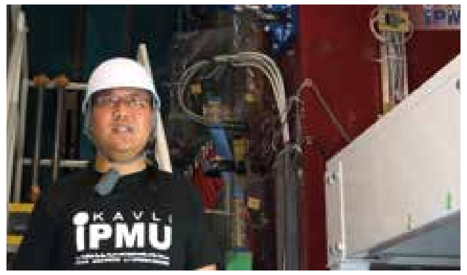



Ask a Scientist

A series of “Ask a Scientist” video clips is shown to the public on the Kavli IPMU website and YouTube. Kavli IPMU researchers explain scientific terms relatel to the research program at the Kavli IPMU in about one minute. Five new clips were released in FY 2013.

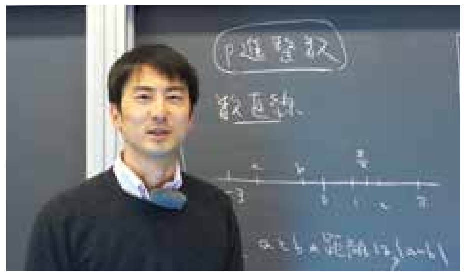
Belle II Experiment
Takeo Higuchi

The shape of space
Toshitake Kohno



T2K Experiment
Chang Kee Jung

The Nobel Prize in Physics 2013
Hitoshi Murayama



p-adic Integer
Satoshi Kondo

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