

FY2014 WPI Site Visit Focused on the Screening of Extension Application

An FY2014 WPI site visit was conducted on September 4 and 5. As the Kavli IPMU had submitted a proposal in June this year in response to the MEXT's call for a five-year extension application of the WPI funding, this time the purpose of the site-visit delegation was to evaluate the progress achieved by the Kavli IPMU as a WPI center since its launch and its progress plan during the extension period as well as the host institution's effort toward its sustainability. The delegation of observers consisted of WPI Program Director (PD) Toshio Kuroki, Deputy PD Akira Ukawa, Program Officer (PO) in charge of the Kavli IPMU Ichiro Sanda, PO in charge of Tokyo Institute of Technology's Earth-Life Science Institute (ELSI) Shoken Miyama, members of the Working Group in charge of the Kavli IPMU (Hiraku Nakajima, Yutaka Hosotani, Tetsuji Miwa, Matthias Staudacher, Ian Shipsey, and Anthony Tyson), some of the WPI Program Committee members (Hiroto Ishida and Michiharu Nakamura), MEXT and JSPS officers, Hideki Iwabuchi (Director, Office for the Promotion of Basic Research, the Basic Research Promotion Division, Research

Promotion Bureau) and others.

The first day was devoted to the overview report by the Kavli IPMU Director Murayama and presentations by Kavli IPMU researchers on research accomplishments in various fields studied at the Kavli IPMU, and finally the presentation of the progress plan by Director Murayama. In this final session, The University of Tokyo's President Junichi Hamada, Executive Vice President for Research Yoichiro Matsumoto, and Executive Vice President Hiroaki Aihara, who is also the Kavli IPMU's Deputy Director, joined the discussion and answered various questions from the site-visit delegation. In the morning of the second day, PD, POs, and members of the Working Group expressed their comments, and the site visit was adjourned.



Kavli IPMU Director Murayama's overview report

The Hermann Weyl Prize 2014 to Yuji Tachikawa

Yuji Tachikawa, an Associate Professor at the School of Science, the University of Tokyo, and a Scientist at the Kavli IPMU has won the Hermann Weyl Prize 2014 for his outstanding contributions to the understanding of supersymmetric quantum field theories; in particular, the discovery of the Alday-Gaiotto-Tachikawa correspondence that has led to spectacular advances in both mathematics and quantum physics.



Yuji Tachikawa

He is the first Japanese awardee of the Hermann Weyl Prize, which was established in 2000 for the purpose of providing recognition for young scientists who have performed original, significant work in furthering the understanding of physics through symmetries. The candidate should either be under thirty-five years of age, or within five years of having received the doctoral degree.

The Kodansha Science Book Prize Awarded to Hiroshi Ooguri

Hiroshi Ooguri, Principal Investigator of the Kavli IPMU (He is also Fred Kavli Professor of Theoretical Physics and Mathematics at the California Institute of Technology (Caltech) as well as the Founding Director of the Caltech's Burke Institute) has won the 30th Kodansha Prize for Science Books for publishing a Japanese popular science book on superstring theory (*大栗先生の超弦理論入門 九次元世界にあった究極の理論* —Professor Ooguri's Introductory Lecture: *Ultimate Theory Is Found in the Nine Dimensional World*, Kodansha Blue Backs, 2013). Established in 1985, it is the only major prize for books written with the theme of mainly natural science but also including S&T, for the general reader in Japan. The 30th prize is given to the best book published in Japan from April 1, 2013 to March 31, 2014. In his book, he introduces Superstring Theory attempting to explain the difficult and challenging theory in easy language, but without compromising its accuracy.

The joint award ceremony of the Kodansha Science Book Prize, the Kodansha Nonfiction Prize, and the



Hiroshi Ooguri

Kodansha Essay Prize was held on September 19, 2014 at the Tokyo Kaikan located in central Tokyo, Marunouchi.

Lurking Bright Blue Star Caught! —The Last Piece of a Supernova Puzzle

A team led by Gastón Folatelli at the Kavli IPMU, the University of Tokyo, has found evidence of a blue star, which is luminous in the near ultraviolet region at the site of supernova SN 2011dh, which occurred in 2011 in the nearby galaxy M51.

SN 2011dh has been known to be a type II supernova, which is the explosion of a massive star due to gravitational collapse at the end of its life. In the images obtained before the explosion, however, a yellow supergiant (YSG) star was detected at the location of the supernova. But YSG stars in isolation were not thought capable of becoming supernovae and controversy arose in the astronomy community. Some researchers claimed that the actual progenitor must have been a blue compact object called the Wolf-Rayet star; it was faint enough in the optical range so that it was not detected in the pre-supernova images of the space telescope and the detected YSG star could have

been a companion of the exploded star, or even an unrelated object that matched the projected supernova location by chance.

In 2012, the team led by Melina Bersten at the Kavli IPMU and Omar Benvenuto at the University of La Plata, Argentina, showed that the exploding star must have been extended, like a yellow supergiant, and that it must have belonged to a binary system. They predicted that, once the supernova has faded enough, the companion could be discovered in the blue range of the spectrum. In March 2013, the HST imaging observational result, which showed the disappearance of the YSG star was announced, and the prediction by the Bersten group was partly confirmed. This time, the observation of a bright blue star at the location of SN 2011dh conclusively confirmed the binary model they proposed. This result has been published in *Astrophysical Journal Letters* **793** (2014) L22. Also, a press conference was held on September 11, 2014, and it has provoked worldwide public response.

Science Café Universe 2014

The annual “Science Café Universe 2014” was held at the Tamarokuto Science Center (TSC) in Nishi-Tokyo City, jointly sponsored by the Kavli IPMU and the TSC. This year, Kavli IPMU Assistant Professor in mathematics Satoshi Kondo gave the first lecture entitled, “Number Theory: A Story of Prime Numbers,” on June 21, and President of the National Institutes of Natural Sciences (NINS) Katsuhiko Sato, who is also a Kavli IPMU Senior Scientist, gave the second lecture entitled “Inflation Theory: Expectation of Its

Observational Evidence,” on July 6.

Since 2012, a Science Café lecture given on July 7, the Star Festival (Tanabata), or on the day before it, has been customarily delivered in the evening at a special venue, the TSC’s planetarium dome which is known as the “Science Egg,” with a Q&A session held in the TSC’s café corner after the lecture. As Professor Sato is one of those scientists who proposed the inflation theory of the universe, he particularly talked about the newest picture of the universe, which might be brought about by the “discovery” of primordial gravitational waves predicted by the inflation theory. This “discovery” was reported in March of this year from an experiment measuring the polarization of the cosmic microwave background at the South Pole. It became big news, but it has yet to be confirmed. (See *Kavli IPMU News* No. 26, p. 38.)



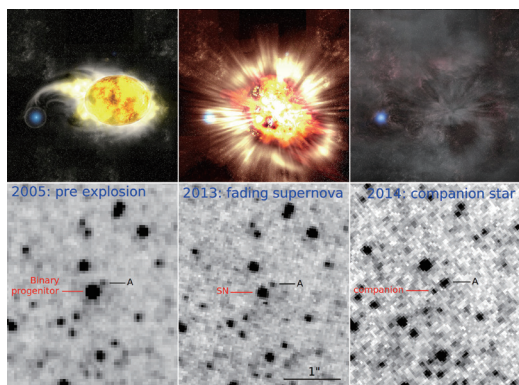
Satoshi Kondo answering questions after the lecture



Katsuhiko Sato answering questions after the lecture

Joint Public Lecture with ISSP “Close Connection between Materials Science and Particle Physics”

On September 28, 2014, a joint public lecture, “Close Connection between Materials Science and



Images in the top row depict an artist's conception of the supernova explosion process. The corresponding images below were taken with the Hubble Space Telescope. The middle top image shows the supernova exploding and the middle bottom image shows the fading supernova after the explosion. (©Top image: Kavli IPMU, Bottom image: NASA, Hubble)

Particle Physics” was held at the Kashiwanoha Conference Center, which is located in front of the TX Kashiwanoha campus station. It was hosted by the Institute for Solid State Physics (ISSP) of the University of Tokyo, and cohosted by the Kavli IPMU and Kashiwa City. Two lectures were given: “One-Dimensional Materials and String Theory,” by Professor Masaki Oshikawa of ISSP, and “Is the Universe Superconducting?” by Kavli IPMU Principal Investigator Hiroshi Ooguri. In these lectures, they explained the close connection between materials science and particle physics in an easy-to-understand manner. They also introduced leading edge research that emerged from collaboration among researchers from both fields.



A scene of Hiroshi Ooguri's lecture

Charles Melby-Thompson Talked at the SSH Students Fair 2014

On August 6 and 7, 2014, the Super Science High School Students Fair 2014 was held at Pacifico Yokohama. In this event, the nine WPI centers, including the Kavli IPMU, jointly ran a booth exhibiting their research activities. In one of the programs, entitled “Researchers Mini Live,” 17 researchers gave mini lectures. Five of them were from the WPI centers; from the Kavli IPMU, postdoc Charles Melby-Thompson enthusiastically talked on, “Watching the Unseen through the Lens of Reason,” in English. His lecture to a full audience was well received, and

after the lecture he was asked a lot of questions, such as, “What is the nature of dark matter?” and, “What is the significance of experiencing study in a foreign country?”



Charles Melby-Thompson talking to SSH students

A Program to Encourage Female Students to Study Science: “Listen to and Look into the Universe”

On August 2, 2014, a Program to Encourage Female Students to Study Science, “Listen to and Look into the Universe,” was held at the Kavli IPMU, jointly hosted by the Kavli IPMU and the Institute for Cosmic Ray Research (ICRR) of the University of Tokyo. The program started from two lectures by female researchers working on leading edge research of the Universe. One of the lectures was given by Tomoko Iwashita, a support scientist at the Kavli IPMU. She spoke on “Where Did Antimatter Go?—Elucidating the Mystery of the Universe Using Accelerators—” In her talk, she explained research conducted at the High Energy Accelerator Research Organization (KEK) at Tsukuba. Another lecture was given by Naoko Oishi, an Assistant Professor at the ICRR, on “The Music Played by Astronomical Objects.” She explained what the gravitational wave is, and then talked about an experiment conducted at the ICRR attempting to directly detect gravitational waves produced by astronomical phenomena. After the lectures, the participants visited

a laboratory where they watched fabrication of a vertex detector with which particle tracks will be measured within a few μm levels of precision. They then learned the principle of the gravitational-wave detector and assembled a tabletop laser interferometer. Finally, they enjoyed friendly conversation with lecturers and graduate students who helped as teaching assistants, about campus life, research, and the like.



Female students talking with lecturers and graduate students

Kavli IPMU Seminars

1. “Lecture 1 on primordial non-Gaussianity”
Speaker: Matias Zaldarriaga (IAS)
Date: Jun 09, 2014
2. “Lecture 2 on primordial non-Gaussianity”
Speaker: Matias Zaldarriaga (IAS)
Date: Jun 09, 2014
3. “Gravity waves from Kerr/CFT”
Speaker: Achilles Porfyriadis (Harvard U)
Date: Jun 10, 2014
4. “Discussion meeting”
Speaker: Matias Zaldarriaga (IAS)
Date: Jun 10, 2014
5. “Natural inflation models in string-inspired supergravity”
Speaker: Tetsutaro Higaki (KEK)
Date: Jun 11, 2014
6. “The CMB after 50 yrs, from discovery to BICEP 2”
Speaker: Matias Zaldarriaga (IAS)
Date: Jun 11, 2014
7. “ATOM/Fastlim: Recasting LHC constraints on new physics

- models”
Speaker: Kazuki Sakurai (KCL)
Date: Jun 12, 2014
8. “Lecture 1 on Effective field theory of large-scale structure”
Speaker: Matias Zaldarriaga (IAS)
Date: Jun 12, 2014
 9. “High precision cosmology with BAO surveys: BOSS and future 21cm BAO surveys”
Speaker: Hee-Jong Seo (OSU)
Date: Jun 12, 2014
 10. “Lecture 2 on Effective field theory of large-scale structure”
Speaker: Matias Zaldarriaga (IAS)
Date: Jun 12, 2014
 11. “Energy conservation and predictability in dRGT massive gravity”
Speaker: Ivan Arraut (Osaka U)
Date: Jun 13, 2014
 12. “Perturbative Quantization of Nonlinear Sigma Models with Symmetries”
Speaker: Timothy Nguyen (SCGP)
Date: Jun 17, 2014
 13. “Cosmology with the Baryon Oscillation Spectroscopic Survey (BOSS)”
Speaker: Florian Beutler (LBNL)
Date: Jun 19, 2014
 14. “Entanglement and Holography”
Speaker: Andreas Karch (U. Washington)
Date: Jun 19, 2014
 15. “Arnold conjecture, Floer homology, and augmentation ideals of finite groups”
Speaker: Andrei Pajitnov (Université de Nantes)
Date: Jun 19, 2014
 16. “Pure Gravity Mediation”
Speaker: Jason Evans (U Minnesota)
Date: Jun 25, 2014
 17. “Galaxies on FIRE: Stellar Feedback Explains Inefficient Star Formation”
Speaker: Philip Hopkins (Caltech)

- Date: Jun 25, 2014
18. “Calculating the Occurrence Rate of Earth-Like Planets from the NASA Kepler Mission”
Speaker: Jessie Christiansen (NASA Exoplanet Science Institute)
Date: Jun 26, 2014
 19. “A Modular Operad of Embedded Curves”
Speaker: Jesse Wolfson (Northwestern U)
Date: Jul 03, 2014
 20. “Boosted Higgs shape at LHC”
Speaker: Michihisa Takeuchi (KCL)
Date: Jul 04, 2014
 21. “ Ω -deformation and quantization”
Speaker: Junya Yagi (SISSA/INFN Trieste)
Date: Jul 08, 2014
 22. “Causality and Hyperbolicity of Lovelock Theories”
Speaker: Norihiro Tanahashi (Kavli IPMU)
Date: Jul 08, 2014
 23. “dRGT massive gravity: the view of an outsider”
Speaker: Ruth Durrer (Geneve)
Date: Jul 09, 2014
 24. “Black hole dynamics at large D”
Speaker: Roberto Emparan (Barcelona U.)
Date: Jul 09, 2014
 25. “Dark Freedom, Early Universe Bounds, and Sky Surveys”
Speaker: Eric Linder (UC Berkeley)
Date: Jul 10, 2014
 26. “The Petrov classification in general relativity”
Speaker: Amir Aazami (Kavli IPMU)
Date: Jul 10, 2014
 27. “SYZ transformation for coisotropic A-branes”
Speaker: Yi Zhang (Chinese U of Hong Kong)
Date: Jul 11, 2014
 28. “Scaling In Quantum Quench : Holography and Beyond”

Speaker: Sumit Das (U Kentucky)
Date: Jul 15, 2014

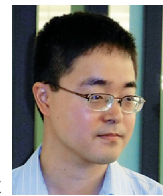
Kavli IPMU Komaba Seminars

1. “Universal formulae for Lie groups and Chern-Simons theory”
Speaker: A.P. Veselov (Loughborough U, UK and U Tokyo)
Date: Jun 16, 2014
2. “On some quadratic algebras with applications to Topology, Algebra, Combinatorics, Schubert Calculus and Integrable Systems”
Speaker: Anatol Kirillov (RIMS, Kyoto U)
Date: Jun 30, 2014

Personnel changes

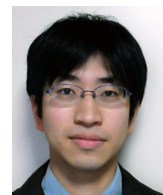
Reappointment

Former Kavli IPMU Assistant Professor Masahito Yamazaki was reappointed on August 16, 2014 after about one-year stay at IAS, Princeton. He told, “I am excited to be back at Kavli IPMU. I have been working on elementary particle theory and string theory. At the Kavli IPMU I am planning to work broadly in the foundations of quantum field theories and string theory, together with other IPMUs.”



Masahito Yamazaki

Also, former Kavli IPMU Postdoctoral Fellow, Yoshiki Oshima was reappointed as a Kavli IPMU Fellow on September 1, 2014.



Yoshiki Oshima

He told, “I am pleased to come back to Kavli IPMU after a one-year stay at IAS in Princeton. My main research interest is in the representation theory of Lie groups. I am working

on branching laws of representations, symmetry breaking operators and related geometries.”

Moving Out

The following people left the Kavli IPMU to work at other institutes. Their time at the Kavli IPMU is shown in square brackets.

Kavli IPMU Associate Professor Shinji Mukohyama [April 1, 2008 – September 30, 2014] moved to the Yukawa Institute for Theoretical Physics, Kyoto University as a Professor.

Kavli IPMU Assistant Professor Satoshi Kondo [April 16, 2008 – October 31, 2008 as an IPMU postdoctoral fellow, and then – August 31, 2014 as a Kavli IPMU Assistant Professor] moved to The National Research University Higher School of Economics in Moscow as an Assistant Professor.

Kavli IPMU postdoctoral fellow Melina Bersten [October 1, 2010 – September 30, 2014] moved to the National Scientific and Technical Research Council in Argentina as a Scientific Researcher.

Kavli IPMU postdoctoral fellow Jyotirmoy Bhattacharya [September 1, 2011 – August 31, 2014] moved to Durham University as a postdoctoral fellow.

Kavli IPMU postdoctoral fellow Biplob Bhattacharjee [September 1, 2011 – August 31, 2014] moved to the Center for High Energy Physics, the Indian Institute of Science as an Assistant Professor.

Kavli IPMU postdoctoral fellow Richard Eagar [September 16, 2011 – September 15, 2014] moved to McGill University as a postdoctoral researcher.

Kavli IPMU postdoctoral fellow Gaston Folatelli [October 1, 2010 – September 30, 2014] moved to the

National Scientific and Technical Research Council in Argentina as a Scientific Researcher.

Kavli IPMU postdoctoral fellow John Kehayias [September 16, 2011 – September 15, 2014] moved to Vanderbilt University as a postdoctoral scholar.

Kavli IPMU postdoctoral fellow Changzheng Li [September 1, 2011 – August 31, 2014] moved to the IBS Center for Geometry and Physics in Korea as an IBS Fellow.

Kavli IPMU postdoctoral fellow Chunshan Lin [August 16, 2011 – August 15, 2014] moved to the Yukawa Institute for Theoretical Physics, Kyoto University as a postdoctoral fellow.

Kavli IPMU postdoctoral fellow Jing Liu [October 1, 2009 – August 21, 2014] moved to the University of South Dakota as an Assistant Professor.

Kavli IPMU postdoctoral fellow Yu Nakayama [September 1, 2013 – August 31, 2014] moved to Caltech as a Senior Research Fellow.

Kavli IPMU postdoctoral fellow Myeonghun Park [October 1, 2013 – September 30, 2014] moved to the Asia Pacific Center for Theoretical Physics (APCTP) as a Leader of Junior Research Group.

Kavli IPMU postdoctoral fellow Daniel Pomerleano [October 1, 2012 – September 30, 2014] moved to Imperial College, London as an EPSRC Postdoctoral Research Fellow.

Kavli IPMU postdoctoral fellow Robert Quimby [September 1, 2011 – August 31, 2014] moved to San Diego State University, as an Associate Professor / Director of Mount Laguna Observatory.

Kavli IPMU postdoctoral fellow Cornelius Schmidt-Colinet [April 16, 2011 – July 31, 2014] moved

to Ludwig-Maximilians- Universität München as a postdoctoral fellow.

Kavli IPMU postdoctoral fellow Yefeng Shen [June 1, 2013 – August 31, 2014] moved to Stanford University as a Postdoctoral Scholar.

Kavli IPMU postdoctoral fellow Valentin Tonita [October 1, 2011 – September 30, 2014] moved to the Foundation Sciences Mathématiques de Paris as a postdoctoral fellow.

JSPS postdoctoral fellow Sho Iwamoto [April 1, 2013 – September 30, 2014] moved to Technion (Israel Institute of Technology) as a postdoctoral fellow.

JSPS postdoctoral fellow Ryo Saito [April 1, 2014 – September 30, 2014] moved to the Yukawa Institute for Theoretical Physics, Kyoto University as a JSPS postdoctoral fellow, accompanying his host researcher, Professor Shinji Mukohyama.

JSPS postdoctoral fellow Norihiro Tanahashi [April 1, 2013 – August 31, 2014] moved to DAMTP, Cambridge University as a Research Associate.

Also, Kavli IPMU postdoctoral fellow Yu-Chieh Chung resigned the Kavli IPMU at the expiration of his term, from August 1, 2011 to July 31, 2014.

Errata

In the Kavli IPMU News No. 26, page 36, leftmost column, immediately below the sub-header “Kavli IPMU Seminars,” the following 5 lines should be deleted.

1. “Naturalness, Conformal Symmetry and Duality”
Speaker: Yoshiharu Kawamura (Shinshu U)

Date: Nov 06, 2013

The numbers of all the seminars that follow should be decremented by one.