

## FY2016 WPI Site Visit

An FY2016 WPI site visit was conducted on September 29 and 30 to evaluate the scientific results recorded by the Kavli IPMU researchers since the launch of the Institute from scratch in October 2007, the level of achievement of the initial implementation plan of the Institute as a WPI center, and its progress plan during the extension period starting from FY2017. The site visit team 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 (Maki Kawai and Michiharu Nakamura), MEXT and JSPS officers, Takuya Saito (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 Kavli IPMU Director Murayama and presentations by Kavli IPMU researchers on representative

research accomplishments as well as 19 poster presentations by young researchers.

In the morning of the second day, Director Murayama presented the progress plan of the Kavli IPMU. The University of Tokyo's President Makoto Gonokami and Executive Vice President for Research Kazuo Hotate joined the discussion and, together with the Kavli IPMU management, answered various questions from the site visit team. In the final session, PD, POs, and members of the Working Group expressed their comments, and the site visit was adjourned.



Director Hitoshi Murayama explaining the Kavli IPMU's future activity program to the site visit team.

## Ninth External Advisory Committee Meeting

On August 22, 2016, the 9th Meeting of the Kavli IPMU External Advisory Committee was held. Chairman Steve Kahn (Stanford/SLAC), and all the committee members, John Ellis (King's College London), Young-Keek Kim (University of Chicago), Sadayoshi Kojima (Tokyo Institute of Technology), David Morrison (UC Santa Barbara), Sadanori Okamura (Hosei University), and Nigel Smith (SNOLAB), were present.

This time, the purpose of the Meeting was to prepare for the FY2016 WPI site visit, and the Committee discussed topics such as "Whether the research and implementation plan of the IPMU as a WPI center, proposed in 2007 when it was launched, has been fully achieved?" and "Whether the

preparation for the five years of extension period is appropriate?" and provided many useful comments and suggestions.



Kavli IPMU External Advisory Committee members discussing with researchers during tea time.

## Hiroshi Ooguri Elected President of the Aspen Center for Physics

Hiroshi Ooguri, Principal Investigator of the Kavli IPMU and Professor of California Institute of Technology, has been elected the President of the Aspen Center for Physics for a three-year term by its board of trustees on July 12, 2016.

The Aspen Center for Physics was established in 1962 in Aspen, Colorado, one of America's picturesque resort areas, to provide physicists with a creative environment for their individual research and to encourage interactions between different fields to open new directions of research. It is a short-stay type physicists' paradise for thinking and talking, and, every year, more than 1000 physicists from around the world come to the Center, mostly in summer and winter. Since 1968 the Center has been an independent non-profit corporation operated for scientists by scientists.

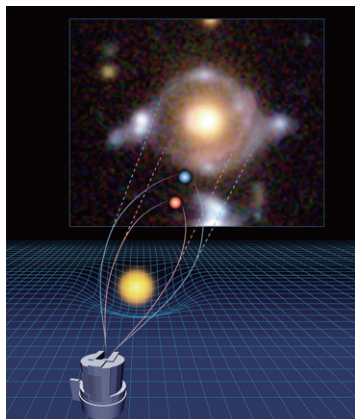
## Hyper Suprime-Cam Found an "Ancient Eye" in the Sky

An international team of researchers from the National Astronomical Observatory of Japan (NAOJ), Kavli IPMU, and other institutes have discovered a rare gravitational lensing effect in the images obtained from the Subaru Telescope's Hyper Suprime-

Cam (HSC). It suggests lensing by a foreground galaxy of two background galaxies at different distances. The rare finding has been dubbed the “Eye of Horus” because of its eye-like appearance, resembling the eye of Horus, the ancient Egyptian sky god.

This discovery was reported in *Astrophysical Journal Letters* on July 25, 2016. Researchers involved in the discovery include Kavli IPMU Postdoctoral Fellows Anupreeta More and Alessandro Sonnenfeld as well as the University of Tokyo Graduate School of Science Assistant Professor Masamune Oguri, who is also Kavli IPMU Associate Scientist. It should also be noted that the first author of this paper, NAOJ Assistant Professor Masayuki Tanaka was at the Kavli IPMU as a Postdoctoral Fellow until March 2013.

In the HSC survey, it is expected to find 10 more systems of the same kind.



Schematic diagram showing the location of galaxies creating the gravitational lens effect of Eye of Horus. A galaxy at 7 billion light years from the Earth bends the light from the two galaxies behind it, one at 9 billion light years, and the other at 10.5 billion light years. (Credit: NAOJ)

### KamLAND-Zen Searched for Neutrinoless Double $\beta$ Decay with World Record Sensitivity

If neutrinos are Majorana particles (the anti-neutrino is the same as the neutrino), neutrinoless double-beta decay ( $0\nu\beta\beta$ ) offers decisive evidence for it, and neutrinos may

be responsible for the dominance of matter over antimatter in the Universe. As a result, a number of experiments world-wide are in intense competition to discover  $0\nu\beta\beta$ .

The KamLAND-Zen international collaboration, led by Kunio Inoue (Director of the Research Center for Neutrino Science, Tohoku University and Kavli IPMU Principal Investigator), has been searching for  $0\nu\beta\beta$  in an unprecedented amount of Xenon-136, the isotope where the double-beta decay occurs, using its ultra-low background liquid-scintillator detector located 1000 m underground in the Kamioka mine in Gifu Prefecture. Kavli IPMU Assistant Professor Alexandre Kozlov is one of the main players in this experiment. Recently, KamLAND-Zen succeeded in dramatically improving the upper limit of  $0\nu\beta\beta$  rate by a factor of 6. This result has been published in *Physical Review Letters* on August 16, 2016 and selected as an Editors’ Suggestion paper.

### Science Café Universe 2016

The annual “Science Café Universe 2016” was held at the Tamarokuto Science Center (TSC) in NishiTokyo City, jointly sponsored by the Kavli IPMU and the TSC. Two lectures were given, first in July and then in September.

On July 3, Kavli IPMU Postdoctoral Fellow Ryo Namba talked about “Primordial Gravitational Waves and Magnetic Fields from the Very Early



During his lecture, Ryo Namba took time out to talk to each group of the audience sitting around the same table.

Universe: Forefront of Cosmology.” About 40 people listened, 70% being high-school and junior high-school students.

On September 4, Kavli IPMU Postdoctoral Fellow Akishi Ikeda talked about the “Deep Relation between Mathematics and Physics: Equation of Everything Derived from Principle of Least Action.” About 50 people listened, 80% being high-school and junior high-school students.



Akishi Ikeda giving a lecture.

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

On August 20, 2016, a Program to Encourage Female Students to Study Science, “Look into the Universe,” was held at the Kavli IPMU. A total of 70 people, including junior high-school and high-school girls, their parents, and teachers listened to two lectures given by Chicago University Professor Young-Kee Kim, who was a former Deputy Director of Fermilab. The lectures were given in English and interpreted consecutively by Kavli IPMU Director Hitoshi Murayama in Japanese. After the lectures, there was a Q&A session, and finally, the attendants enjoyed friendly conversation with Professor Kim and Director Murayama.

### Booth at the 2016 Super Science High School Student Fair

On August 10 and 11, the 2016 Super Science High School Student Fair was held at the Kobe International

Exhibition Hall in Kobe, Hyogo Prefecture. The Kavli IPMU and other 8 WPI centers jointly ran a booth exhibiting their research activities.

### Booth at the New Scientist Live in London

From September 22 through 25, 2016, a science event “New Scientist Live” was held in London. Eight Japanese universities and research institutes, including the Kavli IPMU, OIST (The Okinawa Institute of Science and Technology), Osaka University, RIKEN, and NAOJ (National Astronomical Observatory of Japan) jointly ran an exhibition booth, titled “The Best of Japan Science.”

### Kavli IPMU Seminars

1. “The dark matter halo from hydrodynamic simulations”  
Speaker: Nassim Bozorgnia (U Amsterdam)  
Date: May 18, 2016
2. “Supergravity duals of N=4 theories in 2+1 dimensions on a Coulomb branch”  
Speaker: Akikazu Hashimoto (U Wisconsin, Madison)  
Date: May 18, 2016
3. “Colliding frontiers: the search for new physics at the LHC”  
Speaker: Tom Melia (LBNL / UCB)  
Date: May 23, 2016
4. “Towards a complete  $\Delta(27) \times SO(10)$  SUSY GUT”  
Speaker: Fredrik Bjorkerth (Southampton U)  
Date: May 25, 2016
5. “Gravitational Positive Energy Theorems from Information Inequalities”  
Speaker: Bogdan Stoica (Caltech)  
Date: May 26, 2016
6. “Explaining the LHC 750 GeV Diphoton Excess via Photon Fusion”  
Speaker: Neil Barrie (Sydney U)  
Date: May 26, 2016
7. “Boundedness results on Fano varieties”  
Speaker: Chen Jiang (Kavli IPMU)  
Date: May 26, 2016
8. “Creation of an inflationary universe out of a black hole”  
Speaker: Junichi Yokoyama (RESCEU, U Tokyo)  
Date: Jun 01, 2016
9. “The Co-evolution of AGNs and Galaxies, Viewed from 2D Spectroscopy and Mid-infrared Spectroscopy”  
Speaker: Lei Hao (Shanghai Optical Observatory)  
Date: Jun 01, 2016
10. “Cosmic Gamma-Ray Lines: About supernova interiors, diffuse radioactivity, and black hole accretion”  
Speaker: Roland Diehl (MPE)  
Date: Jun 02, 2016
11. “Exponential networks and representations of quivers”  
Speaker: Johannes Walcher (U Heidelberg)  
Date: Jun 02, 2016
12. “Spread of entanglement and chaos”  
Speaker: Mark K. Mezei (Princeton U)  
Date: Jun 06, 2016
13. “Entanglement, conformal field theory, and interfaces”  
Speaker: Enrico Brehm (Ludwig Maximilian U)  
Date: Jun 07, 2016
14. “Monodromy Dark Matter”  
Speaker: Viraf M. Mehta (Heidelberg U)  
Date: Jun 08, 2016
15. “Divisionally free arrangements of hyperplanes”  
Speaker: Takuro Abe (Kyushu U)  
Date: Jun 16, 2016
16. “On a Canonical Quantization of Pure AdS3 Gravity”  
Speaker: Massimo Porrati (NYU)  
Date: Jun 21, 2016
17. “The Painleve property for the Schlesinger equations”  
Speaker: Todor Milanov (Kavli IPMU)  
Date: Jun 23, 2016
18. “Parabolic Verma modules”  
Speaker: Hisayoshi Matsumoto (U Tokyo)  
Date: Jun 25, 2016
19. “Multidimensional Simulations of Core-Collapse Supernovae & their Impact on Supernova Nucleosynthesis”  
Speaker: William Raphael Hix (U Tennessee)  
Date: Jun 27, 2016
20. “Simulating metallicity distribution in the Universe”  
Speaker: Chiaki Kobayashi (U Hertfordshire)  
Date: Jun 28, 2016
21. “Nonequilibrium Chiral Magnetic Effect in Asymmetric Weyl Semimetals”  
Speaker: Rene Meyer (Stony Brook U)  
Date: Jun 28, 2016
22. “Noncommutative resolutions of discriminants of reflection groups”  
Speaker: Colin Ingalls (U New Brunswick)  
Date: Jun 29, 2016
23. “Latest Results from Advanced LIGO’s First Science Run”  
Speaker: Kipp Cannon (RESCEU, U Tokyo)  
Date: Jun 29, 2016
24. “Physics, Astronomy and Cosmology from the first direct detection of gravitational wave”  
Speaker: Takashi Nakamura (Kyoto U)  
Date: Jun 29, 2016
25. “Iterated convolution of resurgent functions”  
Speaker: Shingo Kamimoto (Hiroshima U)  
Date: Jun 30, 2016
26. “Precision Top mass from energy peaks”

- Speaker: Roberto Franceschini (CERN)  
Date: Jul 01, 2016
27. “Understanding the Explosions of Massive Stars”  
Speaker: Bernhard Mueller (Queen’s U, Belfast)  
Date: Jul 06, 2016
28. “Accretion Induced Collapse of White Dwarf and its Possible Signals”  
Speaker: Shuai Zha (Chinese U Hong Kong)  
Date: Jul 07, 2016
29. “De Rham cohomology of vanishing cycles for non-isolated critical points”  
Speaker: Kyoji Saito (Kavli IPMU)  
Date: Jul 07, 2016
30. “Introduction to the star-triangle relation form of the Yang-Baxter equation and modern applications”  
Speaker: Andrew Kels (Australian National U)  
Date: Jul 12, 2016
31. “The spatially resolved transition between star formation and quiescence with SDSS IV MaNGA”  
Speaker: Francesco Belfiore (U Cambridge)  
Date: Jul 14, 2016
32. “Particle-Vortex Duality from 3d Bosonization”  
Speaker: Andreas Karch (U Washington)  
Date: Jul 26, 2016
33. “On the geometry of thin exceptional sets in Manin’s conjecture”  
Speaker: Sho Tanimoto (U Copenhagen)  
Date: Jul 26, 2016
34. “Primordial anisotropies and asymmetries during inflation”  
Speaker: Hassan Firouzjahi (IPM, Tehran)  
Date: Jul 27, 2016
35. “Recent Developments in the Study of Rational Conformal Field Theories”  
Speaker: Sunil Mukhi (IISER Pune)

- Date: Jul 28, 2016
36. “Novel Approach to Fine-tuned Supersymmetric Standard Models, and the Explanation of the Muon Anomalous Magnetic Dipole Moment Anomaly”  
Speaker: Wen Yin (Tohoku U)  
Date: Jul 29, 2016
37. “Search for Sphalerons: LHC vs. IceCube”  
Speaker: Kazuki Sakurai (Durham U)  
Date: Aug 03, 2016
38. “A localization formula for epsilon factor of algebraic D-modules”  
Speaker: Tomoyuki Abe (Kavli IPMU)  
Date: Aug 04, 2016
39. “3D bosonization and Chern-Simons-matter theory”  
Speaker: Djordje Radicevic (Stanford U)  
Date: Aug 10, 2016
40. “Dark Matter Primordial Black Holes and their Formation”  
Speaker: Encieh Erfani (IASBS)  
Date: Aug 10, 2016

## Personnel changes

### Promotion

Naoyuki Tamura, who was Kavli IPMU Assistant Professor, became Kavli IPMU Associate Professor on August 1, 2016



Naoyuki Tamura

### 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 Assistant Professor Kevin Bundy [September 16, 2011 – September 4, 2016] moved to the University of California, Santa Cruz as an Associate Researcher.

Kavli IPMU Assistant Professor Alexie Leauthaud [September 16,

2011 – January 31, 2013 as an IPMU Postdoctoral Fellow, and then – September 4, 2016 as a Kavli IPMU Assistant Professor] moved to the University of California, Santa Cruz as an Assistant Professor.

Kavli IPMU Project Researcher [Adjunct Assistant Professor] Artan Sheshmani [September 7, 2015 – July 31, 2016] moved to the Ohio State University as an Assistant Professor.

Kavli IPMU Postdoctoral Fellow Ran Huo [September 1, 2013 – August 31, 2016] moved to the University of California, Riverside as a Postdoctoral Fellow.

Kavli IPMU Postdoctoral Fellow Yin Li [April 1, 2016 – September 30, 2016] moved to the Lawrence Berkeley National Laboratory as a Postdoctoral Fellow.

Kavli IPMU Postdoctoral Fellow Ryo Namba [September 1, 2013 – August 31, 2016] moved to McGill University as a Postdoctoral Fellow.

Kavli IPMU Postdoctoral Fellow Andreas Schulze [October 1, 2013 – September 30, 2016] moved to the National Astronomical Observatory in Japan as an EACOA (East Asian Core Observatories Association) Postdoctoral Fellow.

Kavli IPMU Postdoctoral Fellow Yue-Lin Sming Tsai [October 1, 2013 – September 30, 2016] moved to National Center for Theoretical Science (Taiwan) as an Assistant Research Scholar.

Kavli IPMU Project Researcher Kohei Hayashi [April 1, 2015 – March 31, 2016 as a JSPS Postdoctoral Fellow, and then – September 30, 2016 as a Kavli IPMU Project Researcher] moved to the Kavli Institute for Astronomy and Astrophysics, Peking University as a Postdoctoral Fellow.