# News

## Director Murayama Speaks at Symposium on Science and Technology Diplomacy

Kavli IPMU Director Hitoshi Murayama spoke about science and technology diplomacy at an event attended by senior government officials and academics at the National Graduate Institute for Policy Studies (GRIPS) in Tokyo on May 24, 2016.

Hosted by the Cabinet Office, Ministry of Foreign Affairs, Ministry of Education, Culture, Sports, Science and Technology, Ministry of Economy, Trade and Industry, and GRIPS, the symposium was an opportunity to discuss the current state and future of science and technology in diplomacy, taking into account the G7 Ise-Shima Summit that took place from May 26-27.

Murayama pointed out that international organizations such as CERN and a synchrotron light source SESAME under construction in Jordan have led world peace efforts by allowing scientists from different countries to work together. He called on government officials to allow Japan to share its knowledge with other countries, and support future fundamental science projects to further contribute to world peace.

Other notable talks included a welcoming from Minister of Foreign Affairs Fumio Kishida, a speech from Science and Technology Advisor to the Minister of Foreign Affiars Teruo Kishi, and a panel discussion on "A New Direction for Japan's Diplomacy through Science and Technology" between distinguished guests, including Murayama, to debate how Japan's science and technology can better contribute to the global society.


Hitoshi Murayama (far right) with other panelists (Courtesy of the Ministry of Foreign Affairs of Japan)

## Takaaki Kajita and Hirosi Ooguri Receive Chunichi Cultural Award

Takaaki Kajita

Hirosi Ooguri

The University of Tokyo's Institute for Cosmic Ray Research Director and Kavli IPMU Principal Investigator Takaaki Kajita, and California Institute of Technology's Walter Burke Institute for Theoretical Physics Director and Kavli IPMU Principal Investigator Hirosi Ooguri were honored at the 69th Chunichi Cultural Awards at a ceremony in Nagoya on June 3, 2016.

The Chunichi Cultural Awards were established by the Chunichi Shimbun in 1947 to commemorate the enactment of the Constitution of Japan, and they recognize individual and group contributions to the arts, humanities, and natural and social sciences.

Kajita was recognized for his Nobel prize-winning work "discovering that neutrinos have mass, and for discovering neutrino oscillations" using the Kamiokande and Super-Kamiokande detectors located 1000m underground in the Kamioka Mine in central Japan.

Ooguri was recognized for his work "developing cutting edge theories by implementing modern mathematics into elementary particle theory," which includes using modern mathematics to create new superstring theories to help solve fundamental problems in physics.

## Hirosi Ooguri Elected to the American Academy of Arts and Sciences

Hirosi Ooguri was named a new member of the American Academy of Arts and Sciences, it was announced on April 20, 2016.

The academy was established in 1780, making it one of the oldest in the United States, and is considered to be one of the most prestigious honorary societies. Its members have made significant accomplishments in academia, arts, business, and politics.

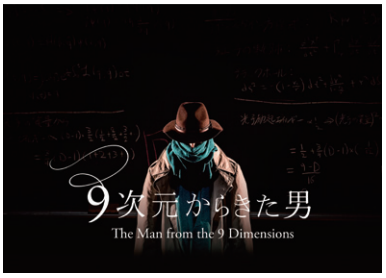
The 213 new members announced this year will be inducted at a ceremony at the academy's headquarters in Cambridge, Massachusetts on October 8.

## Science Movie "The Man from the 9 Dimensions" Supervised by Ooguri Receives an Award at 2016 IPS Fulldome Festival

The International Planetarium Society (IPS) awarded this year's Best Educational Production Award to the 3D dome theater movie "The Man from the 9 Dimensions." It was announced at the IPS Fulldome Festival 2016, held in Brno, Czech Republic from June 15 to 17.

The movie was supervised by Hirosi Ooguri, and was produced by Japan's National Museum of Emerging Science and Innovation (Miraikan). It had just opened to the public in April this year. Directed by noted horror film director Takashi Shimizu, the movie explores the Theory of Everything and follows a group of physicists in pursuit of T.o.E – a man of mystery. T.o.E. takes his pursuers to a world of superstring theory, a leading candidate for the Theory of Everything.

The IPS Fulldome Festival showcased 66 dome theater movies from 15 countries. The Best Education Production Award is the only prize chosen by an international jury. The judges commented that the Man from the 9 Dimensions "is a piece that sparks curiosity, and provides fresh insight into the complex and deep subject that is the Theory of Everything." A prize ceremony was held in Warsaw, Poland on June 23 — the last day of the IPS Warsaw Conference.



Movie poster for Miraikan's "The Man from the 9 Dimensions" (Credit: Miraikan)

## General Theory of Relativity Holds True 13 Billion Light Years from Earth

A team led by Kavli IPMU Postdoctoral Researcher Teppei Okumura and Kavli IPMU Assistant Professor Chiaki Hikage, together with University of Tokyo Department of Astronomy Professor Tomonori Totani, have found that 13 billion light years from Earth, Einstein's general theory of relativity still holds true.

The scientists first used data from the FastSound galaxy survey, collected using the Subaru Telescope, to analyze the velocity and clustering of more than 3000 galaxies about 13 billion light years away, and created a 3D map of the distant universe. By studying the galaxy map in more detail, the researchers managed to calculate the rate at which the distant universe was expanding due to gravity, and found that it was in agreement with the general theory of relativity within experimental uncertainty. This result confirmed the general theory of relativity is correct, and supports the idea that the expansion of the universe could be explained by a cosmological constant which Einstein had proposed.

The results were published online in *Publications of the Astronomical Society of Japan* on April 26, and scientists in the future will need to consider this outcome when developing new models.

## Supermassive Black Hole Wind Can Stop New Stars from Forming

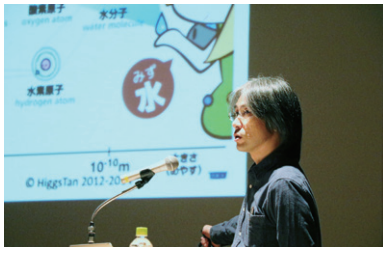
Kavli IPMU Postdoctoral Researcher Edmond Cheung and Kavli IPMU Assistant Professor Kevin Bundy have led an international collaboration that discovered a new class of galaxies called red geysers, where supermassive black hole winds are energetic enough to heat the surrounding gas and suppress star formation. As part of the MaNGA (Mapping Nearby Galaxies at Apache Point Observatory) project using the Sloan Digital Sky Survey telescope and its spectrograph attachment, the team caught red geyser galaxies heating gas within its host galaxy. Despite the fact these galaxies had enough gas for star formation, the wind from the black hole would create an environment too hot for star formation.

The study was published online in *Nature* on May 26, 2016. Also, in this issue of the *Kavli IPMU News*, Kevin Bundy explains this study, see pp. 4-9.

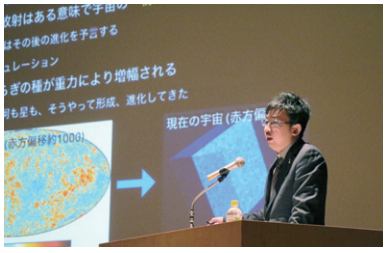
## Kavli IPMU and ICRR Co-Host Public Lecture "Decoding the Universe"

More than 280 young teenagers and adults took part in the 14th Kavli IPMU and Institute for Cosmic Ray Research (ICRR) public lecture "Decoding the Universe" at Amuser Kashiwa in Kashiwa city on April 16, 2016.

Following a welcoming from ICRR Director Takaaki Kajita, ICRR Associate Professor and Kavli IPMU Scientist Yoshinari Hayato gave a talk titled "Neutrinos: What we've learned, and what remains a mystery." He explained what neutrino oscillations were, their interesting properties, and about the research being carried out at the Super-Kamiokande.



Yoshinari Hayato giving a talk.


Takahiro Nishimichi giving a talk.

Then, Kavli IPMU Assistant Professor Takahiro Nishimichi gave

a talk titled "Subaru Telescope: Using big data to uncover the dark properties of the Universe." He talked about topics in precise cosmological theory needed to correctly interpret huge amounts of data from the Hyper-Suprime Cam attached to the Subaru Telescope in Hawaii. He also said "Big-Data Astronomy" using statistical methods and super computers to deal with astronomical big data from observations, is becoming important in astronomy.

Afterwards, the audience was invited to the hall's foyer to chat and discuss ideas with the speakers.

## Kavli IPMU Public Lecture Held with Lisa Randall

On June 19, 2016, Harvard University Professor of Physics Lisa Randall delivered her lecture in the 21 Komcee Lecture Hall at the Komaba campus of the University of Tokyo, where 200 people attended the full house event.

To begin, Shinji Mukohyama, Professor at the Kyoto University Research Institute for Fundamental Physics and Kavli IPMU Visiting Senior Scientist, delivered a lecture titled "Beyond the Imagined 4th Dimension." He explained that from superstring theory — which is thought to be the ultimate theory because it can describe all of the forces of nature, including gravity — extra dimensions beyond the 4-dimensional spacetime are derived. However, as the justification for such extra dimensions cannot be observed, theories have emerged such as that extra dimensions are compactified in such a way that at every point in the 4-dimensional spacetime, there exists a small circle, and that the visible 4-dimensional spacetime clings to a brane inside a higher-dimensional space.

Next, Lisa Randall delivered a lecture titled "Dark Matter and the Dinosaur Extinction." Kavli IPMU Director Hitoshi Murayama, who also provided extended commentary on the points raised, interpreted Randall's presentation into Japanese. Randall raised a new theory — which was introduced in her recently published book for the general public — where a comet collides with the dark matter found in our Milky Way Galaxy, causing the object to impact with the Earth, and possibly resulting in the extinction of dinosaurs.

A question and answer session followed the lectures. Murayama asked questions sourced from the audience — which had been written on post-it notes stuck to a whiteboard — to which the presenters gave answers. Even after the event, the speakers made themselves available, and were surrounded by many inquirers.

Shinji Mukohyama giving a talk


Lisa Randall giving a talk, interpreted by Hitoshi Murayama

(From left) Shinji Mukohyama, Lisa Randall, and Hitoshi Murayama answer questions submitted by the audience

## Kavli IPMU Seminars

1. "Cross correlations with CMB secondaries: constraining cosmological parameters and cluster astrophysics"
   Speaker: Nicholas Battaglia (Princeton U)
   Date: Apr 05, 2016
2. "Moduli spaces in gauged linear sigma model (GLSM)"
   Speaker: Yongbin Ruan (U Michigan)
   Date: Apr 05, 2016
3. "Self-consistent Calculation of the Sommerfeld Enhancement"
   Speaker: Ryosuke Sato (Weizmann Inst)
   Date: Apr 06, 2016
4. "The edge of darkness, and other halo surprises"
   Speaker: Benedikt Diemer (Harvard U)
   Date: Apr 07, 2016
5. "Affine actions from 3-fold flops, and tilings of the plane"
   Speaker: Michael Wemyss (U Edinburgh)
   Date: Apr 08, 2016
6. "The Future of Cosmology with the CMB"
   Speaker: Krzysztof Gorski (JPL / Kavli IPMU)
   Date: Apr 08, 2016
7. "Special subspaces in symplectic vector spaces"
   Speaker: Alan Weinstein (UC Berkeley)
   Date: Apr 11, 2016
8. "Difference Imaging: Algorithms, Problems, and some Possible Solutions"
   Speaker: Robert Lupton (Princeton U)
   Date: Apr 12, 2016
9. "On dark mesonic realization of the SIMP scheme"

Speaker: Min-Seok Seo (IBS)
Date: Apr 12, 2016

10. "Modular forms, new Cardy formulas, and black hole entropy"
Speaker: Edgar Shaghoulian (UCSB)
Date: Apr 13, 2016
11. "A Higgcision study on the 750 GeV Di-photon Resonance and 125 GeV SM Higgs boson with the Higgs-Singlet Mixing"
Speaker: Po-Yan Tseng (Natl. Tsing Hua U, Taiwan)
Date: Apr 13, 2016
12. "Dark energy science from CMB lensing and cross-correlations"
Speaker: Mathew Madhavacheril (Stoney Brook U)
Date: Apr 14, 2016
13. "Geometric and algebraic Poisson modules"
Speaker: Alan Weinstein (UC Berkeley)
Date: Apr 14, 2016
14. "Deformed special geometry and topological string theory"
Speaker: Gabriel Lopes Cardoso (Instituto Superior Técnico)
Date: Apr 19, 2016
15. "Affine braid groups of classical types, baxterization and integrable systems"
Speaker: Anatol Kirillov (RIMS, Kyoto)
Date: Apr 20, 2016
16. "Path toward next-generation CMB missions"
Speaker: Akito Kusaka (LBNL)
Date: Apr 20, 2016
17. "Galaxies, dark matter haloes and how efficient galaxy formation really is: new results from the UltraVISTA survey"
Speaker: Henry McCracken (IAP)
Date: Apr 21, 2016
18. "High energy particle collision and collisional Penrose process near a Kerr black hole"
Speaker: Kota Ogasawara (Rikkyo U)
Date: Apr 22, 2016
19. "Entanglement entropy and higher genus partition function in $AdS_3/CFT_2$"
Speaker: Jie-qiang Wu (Peking U)
Date: Apr 26, 2016
20. "Different aspects of Anisotropic Inflation: From Theoretical side to Observation"
Speaker: Razieh Emami (HongKong U)
Date: Apr 26, 2016
21. "Future prospects of neutrino oscillation study"
Speaker: Osamu Yasuda (TMU)
Date: Apr 27, 2016
22. "The problem of the Mass in SM and Beyond"
Speaker: Luca Merlo (Instituto de Física Teórica, Madrid)
Date: Apr 27, 2016
23. "The gas-galaxy-halo connection"
Speaker: Jean Coupon (U Geneva)
Date: Apr 28, 2016
24. "Grand Unification and Supersymmetry at High Scales"
Speaker: Wilfried Buchmüller (DESY)
Date: May 09, 2016
25. "Recent developments in 2d (0,2) theories"
Speaker: Eric Sharpe (Virginia Tech)
Date: May 10, 2016
26. "The Distant Universe Revealed by Hubble Space Telescope"
Speaker: Robert Williams (Space Telescope Science Inst)
Date: May 11, 2016
27. "Orbit method and characters of representations"
Speaker: Yoshiki Oshima (Kavli IPMU)
Date: May 12, 2016
28. "Cosmic Microwave Background: Neutrino & GUT-Scale Physics from the Cosmos"
Speaker: John Carlstrom (U Chicago)
Date: May 13, 2016
29. "Quest for Dark Matter"
Speaker: Satoshi Shirai (DESY)
Date: May 16, 2016
30. "K-theoretic mirror formulae"
Speaker: Valentin Tonita (Humboldt U)
Date: May 17, 2016

## Personnel changes

### Promotion


Yuji Tachikawa

Yuji Tachikawa, who was at the Kavli IPMU as Assistant Professor between November 2010 and March 2012, became Kavli IPMU Professor on April 1, 2016, following his term as University of Tokyo Graduate School of Science Associate Professor.

Tachikawa speaks of his aspiration, "Assuming I would live to 65 or something, I have already spent a third of my research career. This was a surprising realization that came to me when I got rehired by IPMU. Hopefully I can have as much fun as possible in the next 30 years."

### 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 Professor Krzysztof Gorski [February 8, 2016 – April 15, 2016] returned to the California Institute of Technology Jet Propulsion Laboratory as Senior Research Scientist.

Kavli IPMU Postdoctoral Fellow Lluis Marti Magro [April 1, 2013 – April 30, 2016] moved to The University of Tokyo Institute for Cosmic Ray Research as a Project Assistant Professor.