

News

IPMU Director Murayama's SuMIRe Project Has Launched

Using the Japanese government's FY2009 supplemental budget, ¥100 billion has been dedicated to the "Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST Program)." The aim of this program is to advance the kind of leading-edge R&D that will strengthen Japan's international competitiveness while contributing to society and public welfare through the application of its results. The 30 selected research projects include IPMU Director Hitoshi Murayama's project, "Uncovering the Origin and Future of the Universe: Ultra-Wide-Field Imaging and Spectroscopy Reveal the Nature of Dark Matter and Dark Energy." The project, nicknamed "SuMIRe (Subaru Measurement of Images and Redshifts)," was officially launched in March 2010, and Hiroshi Karoji was appointed Project Manager in April 2010 (see p.8). Dr. Karoji was Director of the Hawaii Observatory (Subaru Telescope) of the National Astronomical Observatory of Japan between April 2002 and March 2006. The SuMIRe project aims at observation and data analysis for the imaging part, and completion of the spectrograph and starting observation for the spectroscopy part by the end of FY 2013.

David Spergel Receives 2010 Shaw Prize in Astronomy

On May 27, 2010, the Shaw Prize Foundation announced that David N. Spergel, Professor and Chair of the Department of Astrophysical Sciences, Princeton University, and IPMU Principal Investigator, had won the 2010 Shaw Prize in Astronomy. The Shaw Prize was created by Run Run Shaw, a magnate in the Hong Kong media and film industry, and consists of three annual awards in Astronomy, Life Science and Medicine, and Mathematical Sciences. Three recipients, Prof. Spergel, Prof. Lyman A. Page, Jr. of Princeton University, and Prof. Charles L. Bennett of Johns Hopkins University, will share this year's prize in Astronomy for their work with the WMAP (Wilkinson Microwave Anisotropy Probe) observation of cosmic microwave background radiation, which has enabled the fundamental cosmological parameters to be determined with unprecedented precision. The awards ceremony will be held on September 28, 2010

Special Public Lecture by George Smoot "The Creation and History of the Universe"

George Smoot, 2006 Nobel Prize laureate in physics, gave a special open lecture presentation at Yayoi Auditorium Ichijo Hall on the University of Tokyo Hongo Campus on April 3, 2010. The lecture was well attended, limited to 320 persons on a first-come first-served basis, with about 100 persons unable to attend due to the capacity of the Auditorium. Prof. Smoot told the story of "The Creation and History of the Universe" inferred from observations, with plenty of beautiful visual images. The lecture was given in English, but Naoshi Sugiyama, Professor of Nagoya University and an IPMU Principle Investigator, presented an introductory

talk before the lecture and interpreted Prof. Smoot's talk in Japanese at short intervals, ensuring the lecture was well understood by the Japanese audience. After the lecture and a Q&A session, a discussion to facilitate dialogue between Prof. Smoot and the attendees with interpretation provided by Prof. Sugiyama was held in the lobby of the Hall.



Prof. Smoot (right) and Prof. Sugiyama (left)

3rd ICRR-IPMU Joint Public Lecture "Decoding the Mystery of the Universe"

On April 17, 2010, the third IPMU-ICRR (Institute for Cosmic Ray Research, The University of Tokyo) joint public lecture titled "Decoding the Mystery of the Universe" was held at the Media Hall of the University of Tokyo's Kashiwa Library. More than 400 people registered in advance, but the capacity of the Hall allowed only the first 120 people to attend. The event opened with a short address by Takaaki Kajita, ICRR Director and an IPMU Principal Investigator. Next, ICRR Associate Professor Masato Takita gave a lecture on "Probing the Universe from the Tibetan Highlands," and IPMU Professor Shigeki Sugimoto spoke on the "Miracles of Superstring Theory: About the Ultimate Picture of Matter." After the lectures and Q&A sessions, ICRR



Prof. Shigeki Sugimoto giving a lecture

and IPMU laboratory tours were held, and each speaker guided the audience through his institution.

IPMU Joined the WPI Presentation at "Science & Technology Festa in Kyoto"

On June 5, 2010, the "Science and Technology Fest in Kyoto (FY 2010 Industry-Academia-Government Collaboration Promotion Conference)" was held at the Kyoto International Conference Center under the auspices of the Cabinet Office of the Japanese Government, the Ministry of Internal Affairs and Communications, Ministry of Education, Culture, Sports, Science and Technology, and other organizations, aiming to publicize the results of the collaborations to a wide audience. All five WPI centers jointly set up a "Experience World-Class Research!" booth as one of the "Special Events for High School Students and Others." IPMU presented panels detailing IPMU activities, a computer demonstration offering visitors a virtual experience of gravitational lensing effects, an "Ask-Scientist" video (<http://www.ipmu.jp/ja/public-communications/ask-scientist>, in Japanese), and other features.

A total of 5,121 people attended Science and Technology Fest in Kyoto and the IPMU presentation was visited by about 450 people.



JISTEC Staff Join the IPMU's Activity to Support Foreign Researchers in Japan

IPMU takes its role in helping foreign researchers with life in Japan very

seriously, so that they can concentrate on their research. For full-time researchers, support consists of the assistance needed to get their life in Japan started, such as foreign resident's registration, housing, and opening a bank account, as well as various needs in daily life. For visitors, it is necessary to help solve the various problems they encounter during their stay. To enhance these services, starting from April 2010, IPMU has entered into a contract with JISTEC (Japan International Science and Technology Exchange Center) which provides the support on behalf of public institutions. JISTEC assigned three support staff, Anna Hamakoji (center in the photo below), Keiko Nishikawa (left), and Xiaoyin Wang (right) to take charge of services for IPMU researchers. They are renowned for the excellent results they have achieved in supporting foreign researchers at NIMS (National Institute for Materials Science) in Tsukuba and its WPI center, MANA (International Center for Materials Nanoarchitectonics). At IPMU, JISTEC's support desk is open every Monday, Wednesday, and Friday in the Reception Office on the 2nd floor. In an emergency, IPMU researchers and visitors can telephone the JISTEC staff on duty for 24-hour assistance.



Dark Matter Distribution in Clusters of Galaxies Deviates from Spherical Shape

A team of astronomers led by Masahiro Takada at IPMU and Masamune Oguri at the National Astronomical Observatory of Japan analyzed the images of 20 massive

clusters of galaxies observed with the Subaru Telescope's Prime Focus Camera (Suprime-Cam) and obtained dark matter distributions from a detailed analysis of the gravitational lensing effects in the images. The team obtained the first evidence that the distribution of dark matter in the clusters has, on average, an extremely flattened shape rather than a simple spherical contour.

The observed non-spherical dark matter distribution in clusters has been predicted by the currently standard dark matter models for the structural formation of the universe. These results represent the first direct confirmation of these theoretical predictions and one of the clues for unveiling the mysterious dark matter. The results of this research will be published in *Monthly Notices of the Royal Astronomical Society*.

The Most Distant Cluster of Galaxies Discovered with Invisible Light

IPMU postdoctoral fellow Masayuki Tanaka, Dr. Alexis Finoguenov of the Max Planck Institute for Extraterrestrial Physics, and Prof. Yoshihiro Ueda of Kyoto University discovered the most distant cluster of galaxies in the universe known to date, 9.6 billion light years away, using light invisible to the eye, at near-infrared and X-ray wavelengths. The paper has been accepted for publication in *The Astrophysical Journal Letters*.

An Unusual Supernova May Be a Missing Link in Stellar Evolution Research

A research group led by Koji Kawabata of Hiroshima University, Keiichi Maeda, Ken'ichi Nomoto, Masaomi Tanaka of IPMU and their collaborators reported observations of a peculiar type Ib supernova 2005cz with the Subaru Telescope and other telescopes, and concluded that this is a supernova

whose progenitor mass at its birth was about ten times that of the Sun. It is theoretically predicted that supernovae from stars that were originally about 10 solar masses should occupy a large fraction of supernova explosions that take place in the universe. However, no such supernovae have been identified. The reason for this may be because these supernovae are faint and become dark quickly. This study identified the properties of supernova explosions of this kind and provided solid confirmation of the stellar evolution theory. The study consequently serves also as an important step forward in understanding the roles of supernovae in the evolution of the universe. This paper has been published in *Nature* (2010 May 20 issue).

**Workshop:
Recent Advances in Mathematics
at IPMU, 2**

A workshop on Recent Advances in Mathematics at IPMU, 2 was held at IPMU on 5-6 April 2010. The workshop focused on various aspects of mathematics, including number theory, algebraic geometry and representation theory developed at IPMU. The speakers included members of IPMU and young researchers from the Graduate School of Mathematical Sciences, the University of Tokyo. The talk by Alexey Bondal described a perspective for grand unification theories in terms of simple Lie algebras and derived categories, which prompted stimulating discussions among mathematicians and physicists.

**Workshop:
Mini-Workshop on Cosmic Dust**

A mini-workshop on Cosmic Dust was held at IPMU on 28-29 April 2010. Cosmic dust grains are solid small particles existing in interstellar space and are fundamental ingredients of the universe. This workshop offered

an opportunity to exchange the latest results about the origin and evolution of cosmic dust, ranging from meteorites to dust detected in the early universe. The participants held a heated discussion about the effect of dust on various observations and its role in the evolutionary history of the universe.

**Future Conference:
Horiba International Conference:
COSMO/CosPA 2010**

The "Horiba International Conference: COSMO and CosPA" will be held from 27 September to 1 October 2010 at the University of Tokyo. Many cosmologists, astrophysicists, and particle physicists will come together from all over the world to discuss the latest results on the evolution of the Universe from its very beginning until the present day.

IPMU Seminars

1. "Spectropolarimetric View of Supernova Explosions"
Speaker: Masaomi Tanaka (IPMU)
Date: Apr 01, 2010
2. "Volume Conjecture and Topological Recursion"
Speaker: Hiroyuki Fuji (Nagoya Univ.)
Date: Apr 06, 2010
3. "Hiding the Higgs with Lepton Jets"
Speaker: Joshua Ruderman (Princeton)
Date: Apr 08, 2010
4. "Lecture 1: Generalities on dg-categories."
Speaker: Bertrand Toen (U. Montpellier)
Date: Apr 13, 2010
5. "Lecture 2: Moduli 1: moduli space of simple objects."
Speaker: Bertrand Toen (U. Montpellier)
Date: Apr 14, 2010
6. "A tale of two spectra: from a gamma-ray puzzle to cosmic rays and dark matter"
Speaker: Alexander Kusenko (UCLA)
Date: Apr 15, 2010

7. "Lecture 3: Moduli 2: moduli of non simple objects and higher stacks"
Speaker: Bertrand Toen (U. Montpellier)
Date: Apr 15, 2010
8. "Oscillatory Modules and Applications to Symplectic Geometry"
Speaker: Boris Tsygan (Northwestern Univ.)
Date: Apr 15, 2010
9. "Lecture 4: Topological and motivic invariants of dg-categories."
Speaker: Bertrand Toen (U. Montpellier)
Date: Apr 16, 2010
10. "New Views of Interstellar Dust"
Speaker: Bruce Draine (Princeton)
Date: Apr 19, 2010
11. "2D Conformal Symmetries, 4D Gauge Theories, & AGT Relations"
Speaker: Masato Taki (YITP)
Date: Apr 20, 2010
12. "lecture 1: Observed Properties of Interstellar Dust"
Speaker: Bruce Draine (Princeton)
Date: Apr 20, 2010
13. "lecture 2: Physics of Interstellar Dust (1)"
Speaker: Bruce Draine (Princeton)
Date: Apr 21, 2010
14. "Decaying dark matter, anisotropies, lines, and the Fermi LAT gamma-ray data"
Speaker: Christoph Weniger (DESY)
Date: Apr 22, 2010
15. "lecture 3: Physics of Interstellar Dust (2)"
Speaker: Bruce Draine (Princeton)
Date: Apr 22, 2010
16. "Taming open/closed string duality with a Losev trick"
Speaker: Andrea Prudenziati (SISSA)
Date: Apr 23, 2010
17. "lecture 4: Dust in Galaxies"
Speaker: Bruce Draine (Princeton)
Date: Apr 26, 2010
18. "Dimer models and exceptional collections"
Speaker: Akira Ishii (Hiroshima Unive.)
Date: Apr 26, 2010

19. "lecture 5: Evolution of Interstellar Dust"
Speaker: Bruce Draine (Princeton)
Date: Apr 27, 2010
20. "Double Compact Objects in Universe"
Speaker: Chris Belczynski (LANL, Warsaw Observatory)
Date: May 06, 2010
21. "Dimer models and exceptional collections (Part 1) Tropical coamoebas and A-infinity categories (Part 2)"
Speaker: Kazushi Ueda (Osaka Univ.)
Date: May 10, 2010
22. "Untying coloured knots"
Speaker: Daniel Moskovich (JSPS/RIMS Kyoto)
Date: May 11, 2010
23. "Matrix Factorizations, Contact Terms and Intersecting Branes"
Speaker: Wolfgang Lerche (CERN)
Date: May 11, 2010
24. "Matrix Factorizations, Contact Terms and Intersecting Branes"
Speaker: Wolfgang Lerche (CERN)
Date: May 12, 2010
25. "Matrix Factorizations, Contact Terms and Intersecting Branes"
Speaker: Wolfgang Lerche (CERN)
Date: May 13, 2010
26. "The geometry of noncommutative singularity resolutions: shrinking exceptional loci to zero size"
Speaker: Charlie Beil (UC Santa Barbara)
Date: May 17, 2010
27. "Classical AdS String : Solutions and Dynamics of Moduli"
Speaker: Antal Jevicki (Brown Univ.)
Date: May 18, 2010
28. "New approach to the cosmological constant problem: q-theory"
Speaker: Frans Klinkhamer (Karlsruhe Institute of Technology)
Date: May 18, 2010
29. "Part 1: First introduction to number theory"
Speaker: Satoshi Kondo (IPMU)
Date: May 19, 2010
30. "Part 2: Algebraic varieties (schemes) and some conjectures in number theory"
Speaker: Satoshi Kondo (IPMU)
Date: May 19, 2010
31. "CDMS II result and Light Higgs Boson Scenario of the MSSM"
Speaker: Shigeki Matsumoto (Toyama Univ.)
Date: May 21, 2010
32. "New constraints on accretion from Optical and X-ray rapid timing observations of black hole binaries"
Speaker: Poshak Gandhi (ISAS, JAXA)
Date: May 25, 2010
33. "Global SO (10) F-theory GUTs"
Speaker: Johanna Knapp (IPMU)
Date: May 25, 2010
34. "The Illuminating Deaths of Massive Stars"
Speaker: Robert Quimby (CalTech)
Date: May 25, 2010
35. "Cosmology as Science? From Inflation to Eternity"
Speaker: Lawrence Krauss (Arizona State Univ.)
Date: May 26, 2010
36. "Primordial Gravitational Waves as Probes of the Early Universe"
Speaker: Lawrence Krauss (Arizona State Univ.)
Date: May 27, 2010
37. "Study of the Galactic structure and halo dark matter by Gravitational microlensing"
Speaker: Takahiro Sumi (Nagoya Univ.)
Date: May 27, 2010
38. "New approaches to numerical Calabi-Yau metrics"
Speaker: Matthew Headrick (Brandeis Univ.)
Date: Jun 01, 2010
39. "Muon Colliders & Frictional Cooling"
Speaker: Daniel Greenwald (Max-Planck-Institute)
Date: Jun 01, 2010
40. "Warped anti-de Sitter spaces from brane intersections in type II string theory"
Speaker: Linda Uruchurtu (Imperial College London)
Date: Jun 08, 2010
41. "A Particle Physicist's Perspective on Topological Insulators"
Speaker: Andreas Karch (University of Washington)
Date: Jun 15, 2010
42. "MSW Instantons"
Speaker: Martijn Wijnholt (Harvard)
Date: Jun 15, 2010
43. "Bullet Cluster: A Challenge to LCDM Cosmology"
Speaker: Jounghun Lee (Seoul University)
Date: Jun 17, 2010

IPMU Komaba Seminar

1. "The correspondence between Frobenius algebra of Hurwitz numbers and matrix models"
Speaker: Akishi Ikeda (The Univ. of Tokyo)
Date: Apr 26, 2010

Personnel Changes

Paul H. Frampton has served as IPMU Professor from September 1, 2009 through May 31, 2010. He has been on a leave of absence from the University of North Carolina at Chapel Hill during this period.

IPMU Assistant Professor Andrei Mikhailov has left IPMU to become a researcher (Pesquisador) at the Institute of Theoretical Physics, Sao Paulo State University. He was at IPMU from September 1, 2009 through June 15, 2010.