

News

Second WPI Follow-up Meeting

The WPI Program Committee held its Second Follow-up Meeting on March 17, 2009. The Committee reviewed the progress of the WPI project based on a summary report by Program Director, Dr. Kuroki, and a progress report from each WPI center presented by the center director, followed by site visit report of the corresponding program officer. At each Follow-up Meeting, attendees hear scientific presentations after the Committee's closed discussion. This time, IPMU Associate Prof., Naoki Yoshida, and IPMU Principal Investigator, Hiroshi Ooguri, gave talks entitled "Physics of the Universe –The First Light–," and "Mathematics of the Universe," respectively.

The Follow-up results have been made public at http://www.jsps.go.jp/english/e-toplevel/data/08_followup/Followup_e.pdf. The Committee evaluated IPMU highly, as it is becoming an "internationally visible WPI research center" within a short time after its launch. The Committee also pointed to the strong and effective leadership of Director Murayama. On the other hand, the Committee mentioned some points that need improvement. Among them are fruitful collaboration between mathematics and physics, the need for tenured positions for researchers, and access to graduate students.

Current Construction of IPMU Research Building

The IPMU Research Building is under construction. Its unique design is thanks to Professor Hidetoshi Ohno of the University of Tokyo and KUHARA Architects. A perspective view of the building is shown on page 15. Construction, begun on February 9, 2009, is currently ongoing at the 3rd and 4th floor level. Its expected completion date is in December, 2009.



Construction area of the IPMU Research Building as of June 10

PR Presentation in the Lobby of the Head Administration Building

Each department of the University of Tokyo takes turns to conduct a presentation in the lobby of the Head Administration Building. The IPMU PR presentation is scheduled from May 15 to mid-July, 2009. It includes a video introduction of IPMU by Director Murayama, and "HATENA Universe" footage, which simplifies technical terms about the universe, by IPMU researchers. There is also an exhibition in the showcase: a computer simulation by IPMU Associate Prof. Naoki Yoshida



Exhibition in the showcase

entitled "The Growth of the Large-Scale Structure of the Universe." Panels detailing IPMU activities are also exhibited.

IPMU Joint Public Lecture with the Institute for Cosmic Ray Research "Telling the Story of Universe"

On April 18, 2009, a joint public lecture entitled "Telling the Story of the Universe" was held for Kashiwa City residents at Amuser Kashiwa Crystal Hall. It was the first time to try co-hosting the lecture with the Institute for Cosmic Ray Research, and it was mutually agreed that two lectures a year would be held (one for Kashiwa City residents). Takaaki Kajita, ICRR Director and IPMU Principal Investigator, hosted the event; Kazuaki Kuroda, ICRR professor, gave a speech entitled "The Mysteries of the Universe Explored using Gravitational Waves"; and IPMU Associate Professor, Naoki Yoshida, gave a speech entitled "Stars and Galaxies Born in the Dark Universe." The lecture drew 233 people, and, in a survey, participants expressed the wish that this kind of event continues, and satisfaction with the front-line stories.

Particle Physics Special Talk Show "Is Missing Antimatter the Largest Magic Show in the History of the Universe?"

On April 18, 2009, the Particle Physics Special Talk Show "Is Missing Antimatter the Largest Magic Show in the History of the Universe?" was jointly hosted with the High Energy Accelerator Research Organization (KEK) at Epochal Tsukuba. It was a predigested show that even elementary school pupils could enjoy, and many families and groups of children gathered for it. During the lecture, "Where did antimatter go?" the audience applauded enthusiastically after IPMU Director Murayama had explained antimatter using character dolls. Afterwards, KEK Assistant Professor,

Takeo Higuchi, introduced the KEKB High-Energy Accelerator in an easy-to-understand manner. Finally, Close-Up Magician, Tomohiro Maeda, performed the “Rules of Energy” magic show, and participants enjoyed taking in the mysteries of both particles and the magic.

Director Murayama’s Talk on Singularities in the Universe at 110th University of Tokyo Public Lecture on *Tokui*

Every Saturday between April 4 and May 16, the University of Tokyo held Public Lectures on *Tokui* at its Yasuda Hall. The Japanese word *tokui* means peculiarity, singularity, or uniqueness. On April 25, IPMU Director, Hitoshi Murayama, gave a lecture entitled “The Singularities in the Universe, the Big Bang and Black Holes.” The lecture was well received by an audience of over one thousand people.

Talk Given to Elementary School Pupils by IPMU Researchers of Various Nationalities

A talk was held on May 22, 2009, at the Tokatsu Techno Plaza in Kashiwa City. Three IPMU researchers of various nationalities, Marcos Valdes, Guillaume Lambard and Susanne Reffert, gave a 10-minute talk each to 5th graders of the local Toyofuta Elementary School, interpretation provided by the IPMU administrative staff. They addressed mysteries of the universe such as what the universe is made of and how it began. They also talked about what researchers are doing at IPMU. The sense of humor they maintained throughout the talk kept the pupils listening with



great curiosity. Among other unique questions, one pupil asked: “If we were sucked down to the middle of a black hole, where would we go?” Pupils became aware of IPMU as a place where many researchers from abroad do research.

Hiroshi Ooguri Uses 3-Dimensional Crystals to Decode Quantum Information in Black Holes

Hiroshi Ooguri (IPMU Principal Investigator) and Masato Yamazaki (School of Science, the University of Tokyo) have shown that each quantum state of a particular class of black holes in string theory corresponds one-to-one to a molten crystal in three dimensions. For example, an ice crystal is formed by water molecules. When it melts, it starts losing molecules from its corners. Similarly, space-time without a black hole is a perfect crystal. As the crystal loses molecules, the black hole grows larger. At the thermodynamic limit, where the size of individual atoms becomes negligible, they showed that smooth space-time emerges and Hawking’s prediction is reproduced. The result of this study was published in the April 24 issue of *Physical Review Letters*.

IPMU Hosts a Meeting of the “InterAction Collaboration” of Particle Physics Laboratories

On April 14 and 15, 2009, a meeting of the “InterAction Collaboration,” whose members represent the world’s particle physics laboratories such as CERN and FERMILAB, was held in the conference room of the University of Tokyo’s Kashiwa Library. The collaboration developed and jointly maintains the interactions.org web site, which serves as a central resource for communicators of particle physics. IPMU joined the collaboration last year and hosted the event this year. During the meeting, the participants exchanged

information on public relations in their countries, and discussed the resolution of foreseen problems and overviews of public relations. A participant from CERN gave an interesting presentation on how to deal with the media, using the movie *Angels and Demons* as an example.

Conference Report

Focus Week: non-Gaussianities in the sky

“Focus Week: non-Gaussianities in the sky” was held at IPMU for five days: April 6-10, 2009. Our universe has various structures at different scales, such as planetary systems, galaxies, clusters of galaxies, and so on. According to the latest theory, this rich array of structures originates from quantum fluctuations in the early universe. In this focus week, leading researchers working on the non-Gaussianities of fluctuations in cosmology gathered together from all over the world and discussed many aspects of the subject, including theories and observations related to inflationary cosmology, the cosmic microwave background, and the large-scale structure of the universe. In a very timely way, a new satellite, “Planck,” was launched on May 14, not long after the end of the workshop. This new observatory is believed to have the potential to detect the non-Gaussianities of fluctuations in the early universe; so, some of the predictions heard during the focus week may be proved in the near future.

Conference Report

Focus Week: New Unchangeable Quantity and Wall Crossing

This focus week was held between May 19 and 22, 2009, in the Media Hall of the Kashiwa Library. The IPMU administrative staff was dealing with

the New Flu precautionary measures, which were taken with regard to all the participants and people concerned. These early precautionary measures and the introduction and use of thermographic measurements meant that the research conference ran smoothly. Further details are reported on page 16.

Future Conference

Dark Energy: Lighting up the Darkness!

The IPMU International Conference "Dark Energy, Lighting up the Darkness!" will be held for five days, June 22-26, 2009, at the Media Hall of the Kashiwa Library on the University of Tokyo Kashiwa campus.

The aim of the conference is to take on the topic of dark energy, which is the biggest mystery of modern cosmology and particle physics. Invited speakers will address such topics as models of dark energy, modified gravity, Ia SNe survey, temperature anisotropies of the cosmic microwave background, gravitational lensing, baryon acoustic oscillation, and surveys of clusters of galaxies using the Sunyaev-Zeldovich effect and X-ray observations.

Seminars

IPMU hosts regular seminars every Wednesday at 3:30 pm. Information is posted on the IPMU website at http://db.ipmu.jp/seminar/?mode=seminar_recent.

Separate seminars are also held for each research fields. At present, seminars for particle physics and astrophysics are held every Thursday at 1:30 pm, mathematics and mathematical physics every Thursday at 3:30 pm. Mathematics seminars are also held at Komaba Campus. (See IPMU Komaba Seminar)

IPMU Seminars

1. "A roadmap to the stars: towards a global strategy for astroparticle"
Speaker: Stavros Katsanevas (IN2P3 / CNRS and IPMU)
Date: Mar 02, 2009
2. "The stellar initial mass function in low metallicity gas"
Speaker: Simon Glover (ITA, Heidelberg University)
Date: Mar 04, 2009
3. "Precision Measurements at Hadron Colliders"
Speaker: C.-P. Yuan (Michigan State University)
Date: Mar 05, 2009
4. "AdS Vacua, Attractor Mechanism and Generalized Geometries"
Speaker: Tetsuji Kimura (YITP)
Date: Mar 05, 2009
5. "A holographic perspective on non-relativistic defects"
Speaker: Andreas Karch (Washington University)
Date: Mar 12, 2009
6. "Pulsars: excellent systems for testing particle acceleration theories"
Speaker: Kouichi Hirotsu (National Tsing Hua University)
Date: Mar 16, 2009
7. "In situ commissioning of the ATLAS electromagnetic calorimeter and early Z⁰ to ee discovery potential"
Speaker: Pierre-Simon Mangéard (CPPM)
Date: Mar 18, 2009
8. "Introduction to the 2-categorical homological algebra"
Speaker: Hiroyuki Nakaoka (The University of Tokyo)
Date: Mar 19, 2009
9. "Dynamics of Hyperpolarized ¹²⁹Xe Production"
Speaker: Geoffrey Schrank (University of Utah)
Date: Mar 24, 2009
10. "Development of segmented germanium detectors for neutrinoless double beta decay experiments"
Speaker: Jing Liu (Max Planck Institut für Physik)
Date: Mar 24, 2009
11. "Splitting Kaluza-Klein spectrum and its phenomenology"
Speaker: Seong Chan Park (IPMU)
Date: Mar 25, 2009
12. "Quantum Resolution of Cosmological Singularities"
Speaker: Neil Turok (Perimeter Institute)
Date: Mar 26, 2009
13. "The Strong Gravity Theorem"
Speaker: Simeon Hellerman (IPMU)
Date: Mar 26, 2009
14. "Is there eternal inflation in the cosmic landscape?"
Speaker: Henry Tye (Cornell University)
Date: Apr 01, 2009
15. "Holography and braneworld black holes"
Speaker: Ruth Gregory (Durham University)
Date: Apr 02, 2009
16. "The Kerr/CFT Correspondence"
Speaker: Wei Song (The Institute of Theoretical Physics, Chinese Academy of Sciences)
Date: Apr 02, 2009
17. "Dark energy or light gravity?"
Speaker: Ruth Gregory (Durham University)
Date: Apr 08, 2009
18. "Improved Holographic QCD"
Speaker: Elias Kiritsis (University of Crete)
Date: Apr 09, 2009
19. "Studying Galaxies and Reionization with 21-cm Cosmology"
Speaker: Rennan Barkana (Tel Aviv University)
Date: Apr 14, 2009
20. "Composite Higgs Physics"
Speaker: Christophe Grojean (CERN)
Date: Apr 15, 2009

21. "Supersymmetry without Prejudice"
Speaker: Joanne Hewett (SLAC)
Date: Apr 16, 2009
22. "On the strong coupling behavior of Wilson loops in N=2 superconformal gauge theories"
Speaker: Takao Suyama (Seoul National University)
Date: Apr 16, 2009
23. "New Insights into Cosmological Gravitational Clustering"
Speaker: Francis Bernardau (Saclay)
Date: Apr 17, 2009
24. "The Landscape of Intersecting Brane Models"
Speaker: Florian Gmeiner (NIKHEF)
Date: Apr 21, 2009
25. "Co-evolution of supermassive black holes and galaxies within their larger-scale structures"
Speaker: John Silverman (EHT-Zurich)
Date: Apr 22, 2009
26. "Duality cascade of softly broken supersymmetric theories"
Speaker: Tetsutaro Higaki (Tohoku University)
Date: Apr 23, 2009
27. "Future foam: Nontrivial topology from bubble collisions in eternal inflation"
Speaker: Yasuhiro Sekino (OIQP)
Date: Apr 23, 2009
28. "Some research on the BESIII experiment offline software"
Speaker: Jike Wang (Institute of High Energy Physics, Chinese Academy of Sciences)
Date: Apr 27, 2009
29. "Gromov-Witten Theory and Integrable Hierarchies"
Speaker: Todor Eliseev Milanov (North Carolina State University)
Date: Apr 27, 2009
30. "Investigation of the sources of the highest energy cosmic rays and neutrinos"
Speaker: Hajime Takami (IPMU)
Date: Apr 30, 2009
31. "Four point functions of higher weight operators in the AdS/CFT Correspondence."
Speaker: Linda Uruchurtu (DAMPT)
Date: Apr 30, 2009
32. "Ghost of massive gravitation in de Sitter space"
Speaker: Keisuke Izumi (IPMU)
Date: May 07, 2009
33. "Landau-Ginzburg model and integrable hierarchies"
Speaker: Yongbin Ruan (University of Michigan)
Date: May 07, 2009
34. "Lecture Series on Topological Strings and Mirror Symmetry at Landau-Ginzburg-Orbifolds"
Speaker: Yongbin Ruan (University of Michigan)
Date: May 08, 2009
35. "K3 surfaces with involution and Borchers products"
Speaker: Ken'ichi Yoshikawa (the University of Tokyo)
Date: May 08, 2009
36. "Lecture Series on Topological Strings and Mirror Symmetry at Landau-Ginzburg-Orbifolds"
Speaker: Yongbin Ruan (University of Michigan)
Date: May 11, 2009
37. "Neutrino Probes of Supernovae"
Speaker: S. Horiuchi (IPMU)
Date: May 14, 2009
38. "Surface operators and AdS/CFT correspondence"
Speaker: Satoshi Yamaguchi (Seoul National University)
Date: May 14, 2009
39. "Residues of Chern classes"
Speaker: Tatsuo Suwa (Hokkaido University)
Date: May 15, 2009
40. "Index and residue theorems in holomorphic dynamics, an overview and some recent developments"
Speaker: Isaia Nisoli (University of Pisa)
Date: May 15, 2009
41. "The elusive neutrino: how double beta decay and the EXO experiment may help unlock its secrets"
Speaker: Andreas Piepke (University of Alabama)
Date: May 20, 2009
42. "Neutrino masses in R-parity violating supersymmetry"
Speaker: Avelino Vicente (IFIC)
Date: May 20, 2009
43. "Search for Dark Matters and Axios"
Speaker: JongHee Yoo (FNAL)
Date: May 21, 2009
44. "The n-category of cobordisms and TQFTs"
Speaker: Alexander Voronov (University of Minnesota)
Date: May 25, 2009
45. "The first generation of galaxies and 21cm fluctuations"
Speaker: Smadar Naoz (Tel Aviv University)
Date: May 28, 2009

IPMU Komaba Seminar

1. "Multiplication in differential cohomology and cohomology operation"
Speaker: Kiyonori Gomi (Kyoto University)
Date: June 08, 2009

Personnel Changes

Changes of Principal Investigators

Two mathematicians, Akihiro Tsuchiya and Michio Jimbo, stepped down as IPMU Principal Investigators on March 31, 2009. IPMU Professor Tsuchiya continues his research at IPMU. Professor Jimbo moved from the Graduate School of Mathematical Sciences, the University of Tokyo, to Rikkyo University, and also left IPMU.

As a result of these changes, IPMU is in the process of finding new Principal Investigators in the area of mathematics.