News

Launch of IPMU

The University of Tokyo's newly founded Institute for the Physics and Mathematics of the Universe (IPMU) , was launched on October 1, 2007. IPMU has been approved as one of the World Premier International Research Center Initiatives (WPI) of the Ministry of Education, Culture, Sports, Science and Technology (MEXT). IPMU is an international research institute. Hitoshi Murayama, MacAdams Professor of Physics at University of California, Berkeley, was appointed as its founding director. The goal of the institute is to discover the fundamental laws of nature and to understand the universe from the synergistic perspectives of mathematics, statistics, theoretical and experimental physics, and astronomy. On January 1, 2008, Hitoshi Murayama became the full-time director of IPMU.

Focus Week: LHC Phenomenology

The first international workshop hosted by IPMU was held on 17 - 21 December 2007. The workshop, "Focus Week on LHC Phenomenology", was organized by Mihoko Nojiri (PI of IPMU) and held at the IPMU, Research Center Building, on the Kashiwa campus.

The Large Hadron Collider (LHC) at CERN in Switzerland will start operating in 2008. The aim of the meeting was to bring together leading experimentalists and phenomenologists working on LHC, to come up with new idea on physics beyond the standard model. To reach this goal, it is necessary to understand phenomena in the standard model: deep theoretical understanding of the standard model, and thus processes and responses involved in the LHC experiments, is essential to identify effects of the new physics in the experiments.

The following invited speakers with a range of expertise were invited. Patrick Meade and Maxim Perelstein are from the new physics side; Jay Wacker, Tilman Plehn, and Chien - Peng Yuan have strong backgrounds in both new physics and QCD (Quantum ChromoDynamics); Steffen Schumann is a QCD expert; Giacomo Polesello and Tomasso Lari are experimentalists who provide ideas on experimental reality, and Teruki Kamon puts the LHC experiments into the cosmological context.

It is all too often that workshops gather scientists to present their results yet leave no time for fruitful discussion. To overcome this, the focus week followed the format propose by Hitoshi Murayama. In the morning the participants had a few long talks, and in the afternoon they had time for intense discussions. On the second day the workshop was held with 11 talks by contributors. "The format worked very well," commented Murayama, "many found the discussion extremely useful for their research, and indeed came up with new projects. The success of the workshop also clarified the importance of follow-up visitor programs, such as one month stays to finalize the projects started in this meeting."

Many theorists found the discussion with experimentalists extremely important, and vice verse. "We developed a consensus that it is important to set a series of workshops to understand phenomena at the LHC and to maximize the performance of the new physics searches," remarked Nojiri.

Hirosi Ooguri wins the Eisenbud Prize

The American Mathematical Society (AMS) announced on January 7, 2008, that Hirosi Ooguri, a PI of IPMU, is a co-recipient of the first Leonard Eisenbud Prize for Mathematics and Physics.

The AMS Eisenbud prize was established to honor work that has strengthened the connection between mathematics and physics, and is awarded only once every three years. Ooguri became the first winner of the prize, together with Andrew Strominger and Cumrun Vafa of Harvard University. The award ceremony on January 7 was held during the Annual Meeting of the AMS in San Diego, California.

The prize was awarded to them for their study on properties of black holes using string theory and the forefront of six-dimensional geometry.

In 1974, Stephen Hawking of Cambridge University shocked the

physics community worldwide by predicting that mysterious black holes are not entirely black but emit their heat in the form of light or particles and may even completely evaporate. However, the origin of their heat remained a big puzzle.

Ooguri, Strominger, and Vafa used string theory and the forefront of higher-dimensional geometry to study properties of small black holes that were beyond the reach of Hawking's theory. They showed that the unseen six dimensions of space explain the origin of the mysterious heat of black holes. Their achievement demonstrated the close connection between the frontiers of mathematics and fundamental questions in physics. "This prize is exciting since it reaffirms my belief that we need both mathematics and physics to understand our universe, and encourages our efforts to jump-start research activities at IPMU," said Ooguri.

IPMU scientists discover that supernovae are not round

On February 1, 2008, Keiichi Maeda, an assistant professor of IPMU, and an international team including Ken'ichi Nomoto, a principal investigator of IPMU, reported that they had uncovered the shape of core-collapse supernovae. They found that supernovae are not round, but rather pencil-like. The result sheds light on actively debated unresolved topics in astrophysics: the explosion mechanisms of supernovae and gamma-ray bursts.

They used the Subaru Telescope to perform spectroscopy and to divide the light from supernovae into different colors. The strength of the light as a function of its color then told the researchers what the shape of the emitting supernova material should be. A pencil-like explosion predicts a characteristic feature -- a combination of slightly bluer and redder lights than its original color -- when viewed from the equatorial direction perpendicular to the direction of the strong explosion. They found that at least five among 18 supernovae showed this feature. Another four supernovae also showed hints of such a characteristic feature.

Considering that pencil-like explosions look round if they are viewed head-on, the probability of seeing the feature of pencil-like explosions viewed sideways indicates that all supernovae are not round. This is the first observational confirmation that supernovae are in general not round. The original work was published in the January 31, 2008 issue of Science Express (the online edition of Science).

Opening Symposium

The Opening Symposium of IPMU is to be held on March 11 and 12, 2008, at the Media Hall, Kashiwa Library, the University of Tokyo. The symposium aims to address all areas of research at IPMU and to discuss future directions, especially on how to realize the synergism of different research areas the physics, mathematics, and astronomy.

For this purpose, IPMU has succeeded in gaining the participation of leaders in the related fields from all over the world. John Ellis at CERN will address particle physics. Kenji Fukaya of Kyoto University will cover topics on algebraic topology and physics. Richard Gaitskell from Brown University will discuss direct dark matter search. Gian Giudice of CERN will address particle physics. David Gross, Nobel Laureate at Kavli Institute for Theoretical Physics, University of California, Santa Barbara, will give overviews on string theory. Masahiko Hayashi of the Subaru telescope, NAOJ, will present various programs at the Subaru telescope. Karl Jakobs of Freiburg University will address particle physics, focusing on the LHC. Art MacDonald from Sudbury Neutrino Observatory will discuss neutrino physics. Nicolai Reshetikhin from University of California, Berkeley, will talk on integrable systems and physics. Yoichiro Suzuki from the Institute for Cosmic Ray Research, the University of Tokyo, will review neutrino physics and dark matter. Simon White from the Max-Planck-Institute for Astrophysics will provide astrophysics background related to IPMU researches. Shing-Tung Yau, a Fields medalist from Harvard University, will describe differential geometry and physics. James Siegrist from Lowrence Berkeley National Laboratory will mention on collaborations including IPMU.

The symposium is preceded by a reception on March 10, that will celebrate the foundation of IPMU.

Focus Week: Neutrino Mass

IPMU has announced that they will host the second "Focus Week" organized by Hitoshi Murayama of IPMU, on March 17 to 21, 2008. The topic of the Focus Week is "Neutrino Mass." It will follow the format of the first Focus Week, i.e., intentionally leave plenty of time with no schedule so that participants can exchange ideas, understand each others' work, and spawn new collaborations.

The "Focus Week: Neutrino Mass" is devoted to the elusive questions of neutrino mass, and will gather experts from various different areas. The following speakers are scheduled to take part. Pasquale Di Bari will give a talk on Leptogenesis. Andrea Giuliani will address Neutrinoless Double Beta (bb0nu)- Decay Experiments. Alex Kusenko will discuss Sterile Neutrinos

in Cosmology. Hitoshi Murayama will review Neutrino Oscillation Phenomenology. Elena Pierpaoli will give a talk on the Galaxy Power Spectrum. Serguey Petcov will address Neutrino Masses, Mixing, Majorana CP-Violation, bb0nu-Decay and Leptogenesis. George Raffelt will give a talk on Supernova Neutrinos. Hamish Robertson will describe the KATRIN (Karlsruhe Tritium Neutrino) Experiment. Vadim Rodin will address bb0nu Nuclear Matrix Elements. Anze Slosar will discuss the Lyman Alpha Forest Power Spectrum and its Use in the Cosmological Context.

In addition to these talks, one afternoon will be set aside for contributed talks aimed at encouraging participation.

Seminars

IPMU frequently hosts seminars given by researchers from all over the world. IPMU seminars are regularly held on every Wednesday, 3:30 pm at the IPMU, Kashiwa campus. IPMU Komaba seminars on Mathematical Physics are held in the Mathematical Science building, Komaba campus. We also frequently hold seminars which do not follow the regular schedule.

IPMU Seminar

Please contact the following organizers for further details: Fuminobu Takahashi, Keiichi Maeda, and Yukinobu Toda. The following seminars have been held or are scheduled to be held (as of 12 February 2008).

1. "String Theory and QCD"
   Speaker: Shigeki Sugimoto (Nagoya Univ.)
   Date: 30 October 2007
2. "Gravitational lensing and dark matter and dark energy"
   Speaker: Masahiro Takada (Tohoku Univ.)
   Date: 8 January 2008
3. "Structure formation in the early Universe"
   Speaker: Naoki Yoshida (Nagoya Univ.)
   Date: 9 January 2008
4. "Holography and entanglement entropy"
   Speaker: Tadashi Takayanagi (Kyoto Univ.)
   Date: 10 January 2008
5. "Discriminating spin through quantum interference"
   Speaker: Matthew Buckley (UC Berkeley / IPMU)
   Date: 16 January 2008
6. "BOSS-The Baryon Oscillation Spectroscopic Survey in SDSS-III"
   Speaker: Jim Gunn (Princeton Univ.)
   Date: 28 January 2008
7. "The mass function of local active black holes"
   Speaker: Jenny Greene (Princeton Univ.)
   Date: 1 February 2008
8. "AGNs and suppressed star formation in massive galaxies at z ~ 2.5"
   Speaker: Mariska Kriek (Princeton Univ.)
   Date: 1 February 2008
9. "Moduli stabilization, F-term uplifting and sequestering in supergravity models"
   Speaker: Hiroyuki Abe (Yukawa Inst.)
   Date: 6 February 2008
10. "Ultralight Gravitino at the LHC"
    Speaker: Koichi Hamaguchi (Univ. Tokyo)
    Date: 13 February 2008
11. "Direct and Indirect Dark Matter Search Experiment"
    Speaker: Yuki Shimizu (Waseda Univ.)
    Date: 14 February 2008
12. "GADZOOKS! A Potential Super-Kamiokande Upgrade"
    Speaker: Mark Vagins (UC Irvine)
    Date: 19 February 2008
13. "Gauge Theory, Gravity and Twistor String Scattering Amplitudes"
    Speaker: Mohab Abou Zeid (KEK)
    Date: 20 February 2008
14. "TBD"
    Speaker: Alexandre Kozlov (Tohoku Univ.)
    Date: 28 February 2008

IPMU Komaba Seminar

Please contact the organizers for further details: Akishi Kato and Toshitake Kohno. The following seminars have been held or are scheduled to be held (as of 12 February 2008).

1. "Topics on string theory, mirror symmetry, and Gromov-Witten invariants"
   Speaker: Shinobu Hosono (Univ. Tokyo)
   Date: 15 October 2007
2. "Some examples of triangulated and/or A∞-categories related to homological mirror symmetry"
   Speaker: Hiroshige Kajiura (RIMS / Kyoto Univ.)
   Date: 29 October 2007
3. "Kontsevich quantization of Poisson manifolds and Duflo isomorphism"
   Speaker: Michäel Pevzner (U. Reims / U. Tokyo)
   Date: 26 November 2007
4. "Deligne conjecture and the Drinfeld double"
   Speaker: Dmitry Kaledin (Steklov Inst. / U. Tokyo)
   Date: 10 December 2007
5. "Analytic torsion for Calabi-Yau threefolds"
   Speaker: Ken-ichi Yoshikawa (Univ. Tokyo)
   Date: 17 December 2007
6. "How to lift a construction by Hiroshi Inose to conformal field theory"
   Speaker: Katrin Wendland (Univ. Augrburg)
   Date: 12 February 2008