Opening Symposium

On March 11 and 12, 2008, the opening symposium of IPMU was held at the Media Hall in Kashiwa Library at the University of Tokyo. The aims of the symposium were to cover all of the research areas studied at IPMU and to discuss ways to bring out the synergies in three core fields of research - physics, mathematics, and astronomy. As many as 172 registered participants took part. IPMU invited an impressive group of leading researchers as speakers for the event. The great success of the symposium can be credited to the high quality of their talks, which combined introductory reviews with news on the latest progress of leading-edge research.

After addresses by Hiroshi Komiyama (President of the University of Tokyo) and Shinichi Kawarada (Senior Deputy Director General of Science and Technology Policy Bureau, MEXT), the talks on the symposium program commenced.

March 11

・"IPMU" by Hitoshi Murayama (IPMU)
・"The state of string theory" by David J. Gross (Kavli Institute for the Theoretical Physics, UC Santa Barbara)
・"Subaru telescope and its prospects for observational cosmology" by Masahiko Hayashi (Subaru Telescope, NAOJ)
・"Geometric structures over space and their applications to physics" by Shing-Tung Yau (Harvard University)
・"Experiments at the new SNOLAB underground facility" by Arthur B. McDonald (Queen's University)
・"New horizons in particle physics - from the Higgs boson to dark matter at the LHC" by Karl Jakobs (University of Freiburg)
・"Implications of the Higgs discovery" by Gian Francesco Giudice (CERN)

March 12

・"Symplectic geometry of Lagrangian submanifold" by Kenji Fukaya (Kyoto University)
・"Experiments at Kamioka underground" by Yoichiro Suzuki (ICRR)
・"The evolution of cosmic structure" by Simon D.M. White (Max-Planck-Institute for Astrophysics)
・"On mathematical problems of quantum field theory" by Nicolai Reshetikhin (UC Berkeley)
・"A noble endeavor - the hunt for dark matter" by Richard Gaiskell (Brown University)
・"Physics perspectives for the LHC" by Jonathan Ellis (CERN)
・"Collaborative opportunities with the US" by James Siegrist (Lawrence Berkeley National Laboratory)

Murayama stressed the need for mathematicians, theoretical physicists, experimental physicists, and astronomers under the same roof to pool their brainpower and solve mysteries in the Universe. This is the very concept of IPMU.

Gross criticized the anthropic principle which states that fundamental parameters in the Universe happen to be the ones that allow the existence of life; he pointed out the importance of understanding how the typical physical scale arises from fundamental physics.

Hayashi summarized recent discoveries with the Subaru telescope, then introduced future improvements - Hyper Suprime-Cam and FMOS.

McDonald spoke on the perspectives of future underground experiments, focusing closely on the SNOLAB experiment. Future experiments will allow us to attack various issues such as dark matter.

Yau reviewed geometric structures over space and their applications to physics: local symmetries, connections, group theory, physics equations, and string theory.

Jakobs reviewed four issues tackled by LHC experiments: the origin of mass, the unification of fundamental theories, the generation problem, and the nature of dark matter and dark energy.

Giudice reviewed implications of what the Higgs discovery by the LHC will lead to in the future. The discovery of the Higgs particle does far more than expand our knowledge of particles: it opens up a new set of fundamental questions.

Fukaya described ways that mathematics and physics connect at various levels, presenting examples such as string theory, mirror symmetry, and so on.

Suzuki outlined several future projects at Kamioka: T2K for the neutrino oscillation study, XMASS and NEWAGE for the direct dark matter search, KamLand for the study of neutrino-less double-beta decay, LCGT for the detection of gravitational wave, and Hyper-K for searching proton decay.

White reviewed state-of-art computer simulations of the formation of the large-scale structure of the Universe. The simulations provide a link between the linear early Universe and today's nonlinear world.

Reshetikhin talked on mathematical problems in quantum field theory. Attacking these problems should increase the interaction between physics and mathematics.

Gaitskell pointed out the importance of direct dark matter detection as a method for probing supersymmetric particle models.

Ellis described several types of questions that can be tackled by experiments at the LHC: the origin of particle masses, the number of matter particles, unification of the fundamental forces, and the quantum theory of gravity. Discoveries by the LHC will set agenda for future projects.

Siegrist spoke on opportunities for US-Japan collaboration.