

# IPMU International Conference Dark Energy: “Lighting up the Darkness!”

Naoshi Sugiyama

Principal Investigator

Masahiro Takada

IPMU Associate Professor

Eiichiro Komatsu

IPMU Visiting Scientist / Associate Professor, The University of Texas at Austin

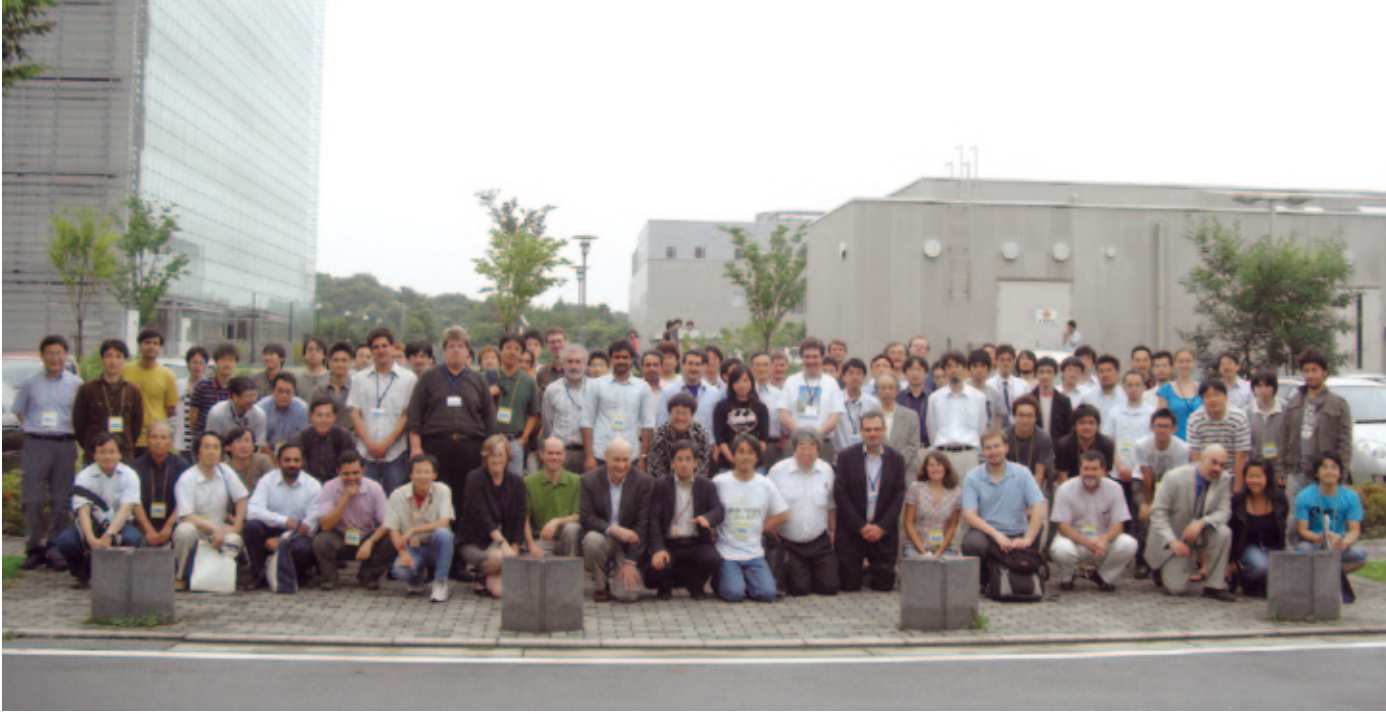
Yen-Ting Lin

IPMU Postdoctoral Fellow

Dark energy is one of the most important and profound problems in modern cosmology and physics. Just ten years ago, based on observations of distant type-Ia supernovae, two independent groups reported a very shocking discovery: the universe today is in an accelerating expansion phase. According to Einstein’s theory of gravity, cosmic acceleration implies that the universe is occupied by a mysterious energy component known as dark energy, which continues to emerge in space as the universe expands and acts as a repulsive force, pulling galaxies further apart from each other. The nature of dark energy will determine the ultimate fate of our universe. It might continue to expand eternally, or it could begin to contract at some point in the future. Another possible alternative is the so-called Big Rip, in which all matter in the universe, including stars, galaxies, and atoms, are progressively torn apart at a certain point in the future. Even Nobel laureate and renowned particle physics theorist Frank Wilczek (MIT) called the dark energy problem as “maybe the most fundamentally mysterious thing in basic science.” As an entirely different

explanation of cosmic acceleration, in recent years many cosmologists have also argued that cosmic acceleration may be a sign that Einstein’s gravity theory breaks down on cosmological distance scales.

Cosmological observations are needed to explore the nature of dark energy (or more precisely the nature of cosmic acceleration). For this purpose massive surveys of the universe are being planned all over the world. One such survey is the Subaru Telescope Survey slated to get underway in 2011 with a new wide-field camera. IPMU will be involved in this research. Several promising ways of approaching dark energy are being seriously studied: cosmic microwave background, supernovae, baryonic acoustic oscillation measured via the clustering statistics of galaxy distribution, weak shearing effects on distant galaxies, and the counting statistics of galaxy clusters. Hence, the primary tasks of each of these methods are currently (1) developing a theoretical modeling of the dark energy measurement methods that is accurate enough for the desired precision of dark energy measurement, and (2) understanding sources of systematic errors



involved in each method.

Against this research background, this international conference was put together. It brought together many prominent scientists from all over the world as invited speakers, for a five-day conference consisting of invited and contributed presentations (41 in total). Starting with an opening review by Prof. Michael Turner (Chicago), the conference continued with sessions covering a broad range of topics: dark energy measurement methods, recent developments in theoretical studies of dark energy, and the potential for modified gravity on cosmological scales. Each session started with a talk by an invited speaker, which was followed by contributions selected from registered presentations, each of which stimulated active discussion among the participants. We also had 24 poster presentations. We received a great deal of positive feedback on the conference from many of the 134 participants in total, which included 55 foreign participants. In short, this IPMU international conference was a success.

On the middle day of the conference, the organizers arranged for the IPMU public lecture

given by Prof. Michael Turner. Even though this was the first English-language public lecture hosted by IPMU, the conference room was filled to capacity with more than 160 people attending. It seems that Michael's talk was quite accessible to most of the audience thanks to the help of a presentation file translated into Japanese as well as brief summaries made by one of the organizers, Naoshi Sugiyama, during the talk. For example, Michael's jokes often sparked a ripple of laughter from the audience. Also Michael received a significant number of questions after his talk, taking us past the scheduled ending. All this is evidence that the public lecture proved even more successful than anticipated by the organizers.

The organizers would like to thank to all participants for contributing to the success of this conference. We very much hope to hold another conference in a few years to discuss our progress (or perhaps resolution!) of the dark energy problem. Finally we would like to thank the administrative staff for supporting the organization and operation of the conference.