FY 2008 WPI Project Progress Report
World Premier International Research Center (WPI) Initiative

Host Institution	The University of Tokyo	Host Institution Head	Hiroshi Komiyama
Research Center	Institute for the Physics and Mathematics of the Universe	Center Director	Hitoshi Murayama

Summary of center project progress

Institute for the Physics and Mathematics of the Universe (IPMU) has made steady progress towards the stated goals. The numbers below refer to the period between April 1, 2008 and March 31, 2009, unless stated otherwise.

(1) Organization. The number of administrative and research support staff has exceeded the proposed number of 30. The scientific staff is also steadily growing, from 63 to 125, well on track towards the proposed goal of 195 (March 2011).

(2) Internationalization. The WPI program requires more than 30% of the researchers to be non-Japanese. Our current percentage is 48%, and has fulfilled the mandate. The most significant among the non-Japanese members is one full and two associate professors who have moved from US institutions, two American and one German nationals. The fraction of bilingual administrative and support staff is 48%, very close to the proposed 50%.

(3) Infrastructure. IPMU has constructed underground laboratory space for developing and testing equipments and materials for experiments. The prefab complex on the Kashiwa campus is completed, but we are already short of space to house increasing number of researchers. Construction of the Kamioka satellite research building has been completed and occupancy started since February 2009. Construction of the new research building began in January 2009. The current schedule for occupancy aims October 2009. The new international guesthouse is scheduled for opening in October 2009.

(4) Scientific activities. IPMU has held 7 international conferences and 156 seminars. Among the 372 visitors, 103 came from abroad. A total of 148 papers have been written and 68 were published. Noteworthy is a paper published in Science co-authored by PI Nomoto and his collaborators on new types of supernovae. XMASS and HyperSuprimeCam projects are making steady progress, and the MoU to join SDSS-III experiment was signed.

(5) Honors and Awards. PI Ooguri received the 2009 Humboldt Research Award, and Prof. Sugimoto received the 2008 Kimura prize of theoretical physics. Assoc. Prof. Yoshida received the IUPAP Young Scientist Prize in computational physics, and Assoc. Prof. Komatsu (joint appointment with Texas) received the same Prize in astrophysics. PI Nakahata received the 2008 Inoue Prize for Science. PI Inoue received the 2008 JSPS Prize.

(6) Interdisciplinary activities. As proposed, we hold daily tea at three o'clock to encourage informal and interdisciplinary discussions. They are well attended and create desired atmosphere. Seminars are also organized across the traditional boundaries, one colloquium for all fields, one seminar for astronomy and particle phenomenology, one for string theory and mathematics. Five papers were coauthored jointly by mathematicians and physicists as a result.

(7) Outreach and Publicity. IPMU organized 3 public lectures by Director Murayama, twice at Kashiwa campus and once at Hongo Campus. We also held a series of 5 public lectures by PIs (Murayama, Ooguri, Sato, Inoue, Sugiyama) at a science museum in Tokyo. IPMU published four editions of IPMU News. IPMU was covered 81 times in media.

(8) Response to the Follow-up Committee. IPMU secured a core of theoretical PIs, Yanagida, to become full-time on site starting the next fiscal year. University agreed to provide IPMU two six-year positions, one of which will be used to further reduce duties of PI Aihara. Some IPMU members (Murayama, Saito, Tsuchiya, Yoshida) were granted rights to take graduate students and the list will expand. Equipments were purchased to broadcast some of the seminars, and some are already archived and posted on the web.

1. Summary of center project

<Initial plan>

This center aims at establishing a multi-disciplinary research institute with the unifying goal of understanding the universe from the synergistic perspectives of physics, cosmology and mathematics.

The institute brings the world's leading theoretical physicists and mathematicians together to develop new formulations of the fundamental laws of nature, a crucial step toward solving the mysteries of the universe. We will develop infinite analysis, the mathematics for systems with infinite dimensional degrees of freedom, which will be used to build new physical theories and derive their experimental predictions and to invent statistical methods to analyze geometric data.

We will study dark energy, dark matter, neutrinos, and physics beyond the Standard Model of elementary particle physics. The institute builds on the state-of-the-art facilities (Super-Kamiokande, KamLAND, Subaru telescope, and LHC accelerator) that will produce an unprecedented amount of precision data for observational cosmology, astronomy and elementary particles physics. We aim to develop new mathematical tools to analyze the data by taking full advantage of collaboration between mathematicians and physicists, and will develop new experimental strategies to attack the mysteries.

This center is a unique research institute in the world on the forefront of physics, cosmology and mathematics and will lead to a new paradigm of sciences in the 21st century. It will attract highly motivated young researchers, as well as established leading scientists from around the world and will greatly strengthen the foundation of mathematical and physical sciences in Japan.
We will also bring topnotch female researchers as role model to inspire women in Japan and promote Asian diversity.

<Results/progress/alternations from initial plan>

None of the initially stated plan has been changed, while we are making progress toward our goal.

In addition to the progress described in "Summary of center project progress," there are other noteworthy items.

1. Restricting to the on-site scientific staff full-time paid by IPMU, the fraction of non-Japanese researchers has exceeded 50%.

2. We had submitted Letter of Intent to join SDSS-III collaboration, and it is now partially funded by NSF and Sloan Foundation in the US. The project has officially started and we signed a Memorandum of Understanding.

3. To bolster exchanges of scientific staff with leading research institutions worldwide, we have now agreement with CERN theory group, DESY theory group, UC Berkeley Center for Theoretical Physics, Caltech particle theory group. MoU is in the works with DESY, Cluster of Excellence Munich/Garching, LeCosPA in Taipei, Tsinghua University.

4. Kavli Foundation has visited IPMU and is interested in contributing approximately $7.5M. University is trying to establish a foundation in the US to satisfy their requirement of 5% return of investment on average.

5. As a part of outreach activities, IPMU has started a series of short video clips to explain technical scientific terms to general public.

2. Research fields

<Initial plan>	<Results/progress/alternations from initial plan>
Physics and Mathematics ・ Describe the importance of the proposed research, including domestic and international R&D trends in the field and Japan's advantages. ・ If centers in similar fields already exist in Japan or overseas, please list them. Science's fundamental and historic search for the fundamental laws of Nature is built on the invention of new mathematics, and it has inspired many important developments in the field. Famous examples include the simultaneous invention of Calculus and Newton's mechanics and the use of Riemannian Geometry in General Relativity. The interface of physics and mathematics is alive and well. Approximately 40% of Fields Medalists in mathematics since 1990 have worked in areas closely related to quantum field theory and string theory. Conformal field theory in two dimensions, whose development was largely motivated by string theory, has been used to explain the remarkable identities about the Monster group (Field Medal to Borcherds) and to describe stochastic geometry (Fields Medal to Werner). Methods of topological string theory have revealed deep connections among the Gromov-Witten invariants, gauge theory instantons, and combinatorics (Fields Medals to Kontsevich and Okounkov). In return, these mathematical developments have provided powerful tools for quantum field theory and string theory. No other area of science has had such a great impact on mathematics in the past few decades, and the rate of progress in this area suggests that this trend will only accelerate in future. As stressed, for example, in a recent National Research Council report, "Rising Above the Gathering Storm," in the United States, building up strength of mathematical and physical science is a key to lead in a highly competitive world scene of science and technology. Coincidentally, the Science Council of Japan warned recently that Japan's foundation of mathematics is at risk due to not attracting young talented minds into this fundamental field. At the proposed Institute, we will build a community of physicists and mathematicians, redefine the boundaries between them and help nurture future generations of mathematical scientists. Uniquely to this Institute, we anticipate cross-career development between mathematics and physics, such as a statistician moving to experimental physics.	Physics and mathematics of the universe stays one of the most important areas of scientific research today. The 2008 Nobel prize in physics to Nambu, Kobayashi, and Maskawa signifies importance of this area of research. Although there has been no major breakthrough in recent months, researchers worldwide are making steady progress in each of their fields.

Mathematicians and physicists have very different work styles. Although two PI's for mathematics stay in their current Komaba campus, Tsuchiya and Saito will reside in Kashiwa as Principal Investigators, who facilitate communication between physicists and mathematicians and maintain activities in this area throughout the year. There will be semi-annual workshops that bring mathematicians and physicists together where they will share their common problems. Once that is established, they will keep communicating over phone and video on individual bases, visiting each other on as-needed basis, as well as organized seminars broadcast over the video to maintain mutual interest. We also plan to have a state-of-art video conference system and internet-blackboards between Kashiwa and Komaba that stay on 24/7 to make impromptu discussions possible.

Our advantage of experimental programs is evident. Japan continues to lead the field of underground physics including dark matter search and study of neutrinos by capitalizing on two major underground detectors (Super-Kamiokande and KamLAND) at Kamioka, where a satellite of the Institute will be established. Some principal investigators of the Institute are now building a new instrument that enables a wide-field, deep survey of galaxies at Subaru telescope. The data from this instrument will most likely dominate the field of observational cosmology and astronomy well into the next decade. Scientists in our Institute will have the first-hand access to high quality, high precision data available from these world premier facilities. LHC, the world highest energy accelerator, will become operational by the end of this year and the data of high energy collisions that mimic Big Bang, the birth of the Universe, will be available to us. By bringing together the world-leading mathematicians, theoretical physicists and experimental physicists and taking advantage of the data available at the Institute, we will take on challenges of solving the mysteries of the Universe. This is another reason why most active world-class scientists should come to work at the Institute.

The Institute we will establish is a unique research center in the world that spans pure mathematics, theoretical physics, experimental physics, astronomy, and applied mathematics. This kind of Institute will be truly unique in the world. Kavli Institute for Theoretical Physics is an excellent institution, yet does only theoretical physics. There are many first-rate institutions that combine research in mathematics and theoretical physics, such as Isaac Newton Institute for Mathematical Sciences in Cambridge, Institute for Advanced Study in Princeton, IHES in France, and MSRI in Berkeley, but none of them include experimental physics in their program. There are also great institutions on both theoretical and experimental

physics, such as CERN, Fermilab, SLAC, KEK, but none of them have mathematicians. The combination of science the proposed Institute will include should attract best people from the world because of its uniqueness and potential for major breakthroughs. This project is timely and important in that Japan has currently positioned herself to lead this research field and in that this initiative meets demand for Japan to keep a cutting edge in global and competitive Science and Technology environment.	

3. Research objectives

<Initial plan>	<Results/progress/alternations from initial plan>
・ Describe in a clear and easy-to-understand manner the research objectives that the project seeks to achieve by the end of the grant period (in 10 years). In describing the objectives, the following should be articulated in an easily understandable manner: What new domains are expected to be pioneered by fusing the target fields. In the process, what world-level scientific issues are sought to be resolved. What is the expected impact of the scientific advances to be achieved on society in the future. ・ Describe concretely the research plan to achieve the objectives, and any related past achievements by the host institution. At this Institute we address big questions about the universe, its fundamental laws, its beginning, its fate, and its mysterious components, such as Dark Matter and Dark Energy. For this purpose, we will create new mathematics needed for the unified description of the universe. It will enable new physical theories with testable predictions. Technological innovations follow to make new experiments possible; whose data will further stimulate development in mathematics. This upward spiral will move the science forward, exciting the public at large and motivating students to enter mathematics, science, and engineering to become the next-generation workforce. Even though it is difficult to accurately predict the possible deliverables from this Institute aimed at basic (not applied) research, here are a few examples of new possible domains we may pioneer on the ten-year time scale:	Since there has been no major breakthrough which forces us to alter our approach, there are no changes in our research objectives as stated in the initial plan. We are proceeding according to the initial plan.

- Effort by string theorists to enumerate and classify solutions leads to development of new class of geometries.
- New data on dark matter from underground and accelerator experiments of the Institute require new paradigm in particle physics changing the course towards the unified theory in physics, and require new mathematics.
- Mathematical developments in integrable systems allow string theorists to work out new class of solutions that suggest a dynamical behavior of Dark Energy, and prompt new type of observational strategies in spectroscopic galaxy surveys.
- The vast data from the next-generation galaxy surveys nudge the applied mathematicians and statisticians to develop a novel method to extract subtle information from the last data set, uncovering an unanticipated new behavior of Dark Energy.

In all anticipated examples including those above, pure mathematics, theoretical physics, experimental physics underground, astrophysical, and accelerator-based, and instrumentation will motivate each other's efforts in a way not possible in the usual structure of academic institutions where these activities tend to be decoupled from each other. All of these scientific objectives are keenly shared worldwide, and any discoveries at the Institute will have immediate impacts on the global scale.

To ensure this cross-development of this type, we assembled an amazing group of researchers from around the world. They all have a strong track record in working on subjects not confined in their specific research areas, but extend well beyond the boundaries.

The Institute also builds on the strengths of the Japanese science community in many ways. University of Tokyo and Tohoku University lead the world in well-known success in neutrino physics and move to wider scopes of underground experiments such as dark matter searches. The Subaru telescope, the largest field of view among the world 8m class telescopes, will be exploited.
There is a long tradition for physicists and mathematics to work together which was especially true in the 90's and can be revamped in the 21st century. There is close relationship between theoretical and experimental particle physicists working on physics beyond the standard model which is unparalleled in the world.

- We hosted a Focus Week "Quantum black hole" for deepening our understanding the physics and mathematics of the black hole with a particular emphasis on exploring new mathematics of the black hole. Focus Week is an IPMU-style one-week long international workshop where a group of most active researchers in the specified field gather and have intense discussion.
- We hosted two LHC phenomenology Focus Weeks, one for continuing our study of LHC phenomenology and developing methodology to detect new physics signals such as dark matter, extra dimensions, and black hole, and other for more specific approaches for determination of masses and spins of new particles at LHC.
- We hosted 3 international conferences in mathematics, one for deepening our understanding of mathematical symmetries ("Moonshiney conference"), one for algebraic geometry ("Exceptional collections and degenerations of varieties"), and one for supersymmetry in complex geometry. We also held 2 mathematics workshops, one for symplectic manifolds and other for topological string theory.
- We are fabricating a new wide-field CCD camera for Subaru Telescope. This new camera is more than 10 times powerful than the current one and will produce more than 500 Giga Bytes per night once it is deployed. We have started to design a set of computer programs (called pipeline) that can handle and process the data and produce a catalogue of observed several hundred million galaxies. The catalogue will be released to the scientific community worldwide.

We expanded full time scientific staff to 8 professors, 8 associate professors, 3 assistant professors, and 20 postdoctoral fellows. Total number of scientific staff including principal investigators, full time staff, joint appointments and long-term visitors (more than one month) reached 125. We published 68 papers in refereed journals, produced 148 preprints, many of which are being submitted to refereed journals. We held 156 seminars. We are visited by 372

The research plan is mostly about bringing in superb scientists in the relevant areas as termed professors, postdocs, and visitors. All Principal Investigators have a strong track record in securing and managing competitive grants for their research. Focused workshops at the interface of physics, mathematics, and astronomy will bring in worldwide leading scientists to the Institute and breed new directions in the fields and redefine their boundaries. Generous start-up packages and seed money for developing new ideas towards future experiments will bring in competitive grants further. Frequent interactions among the PI's ensure new directions will emerge at the interface of the traditional boundaries of the subfields. We anticipate big societal impacts of the Institute in the following way. The questions that the proposed Institute addresses are easy to relate to for laypersons. Excitement in the new paradigms in our understanding of the universe spark interest and imagination among young students and more of them enter the fields of mathematics, sciences and engineering to build a stronger future workforce. New experimental initiatives from the Institute will require new technologies in particular in instrumentations, which get transferred to the industry for new purposes. For instance, development in multi-fiber technology needed for future galaxy surveys may well lead to medical applications. It also reverses the tide of brain-drain from Japan not only by bringing back the Japanese researchers who left the country, but also bringing worldwide researchers to Japan because of the attractive research opportunities.	scientists, of which 103 from abroad.

4. Management

<Initial plan>	<Results/progress/alternations from initial plan>
1) Composition of administrative staff The administrative staff is an integral part of the Institute. The administrative organization belongs to Directorate that consists of the Director, Deputy Directors and Administrative director. Because this Institute belongs *directly* to the Office of the President (without any other intervening layers of administration), the University has committed to make administration resource at the University headquarter available to the Institute. The Institute directorate will have direct access to the administration office at the University headquarter and will share its resources. With this direct coupling to the Office of the President, we envision our administrative organization will	1) Composition of administrative staff The number of administrative staff (including research support staff) as of March 31, 2009 is 33, an increase of 16 from April 2008. The Administrative Director supervises entire administrative matters with the help of a deputy administrative director and an administration chief. There are 7 staff in the general affairs and human resources section (including 1 public relation specialist and 3 secretarial staff), 3 staff in the salary and travel expense section, 6 staff in the international affairs section (including 1 conference organizer and 2 Japanese instructors), 2 staff in the finance and budget panning section, 3 staff in the contract and purchasing section, 4 staff in the

be streamlined, yet very effective to provide the best possible environment to the researchers in the Institute. On site, we will have, under the administrative director's supervision, offices devoted to 1) general affairs and human resources, 2) financial/budget planning and accounting 3) information and public communication/outreach, and 4) international affairs. Each office consists of a chief officer and a few assistants. These offices will perform day-to-day administrative function and will, whenever necessary, work directly with the directors of the institute. The office of international affairs is particularly important for the institute. It helps our foreign employees and visitors to find houses, international schools for their children, and helps for organizing international conferences and workshops. We hire skilled experts for many sections and plan to fill more than 50% of staff member positions by persons who are bilingual.	Kamioka Satellite office, 2 staff in computer and network, one each in the library, facilities, and documentation works.
2) Decision-making system As shown in the organization chart included in the section of Project Summary, except for personnel decisions regarding the center director and principal investigators (PI's), which will be made by the President, the center Director has a complete authority of making a wide range of decisions, including proposing recruitment of PI's to the President, appointing staff researchers, postdoctoral researchers, research support staff members and administrative employees. The Director will be assisted, whenever needed, by two deputy directors and by the administrative director. The administrative director conducts administrative business and oversees the staff members who take care of visitors from other Japanese institutions and from abroad. His function enables the Director to spend more time to consider the Institute at large and to focus on the direction of the research. The Director will have direct access to the Office of the President and will be able to consult with the President and his assistant staff members. The Scientific Advisory Committee (SAC) reporting to the Director consists of four to five PI's of his choice. They advise the Director on planning of hiring staff members as well as scientific directions. The role is strictly advisory. The Director is solely responsible for making the final decisions. The PI's have a large autonomy in the research they conduct and they are encouraged to fund their research through competitive grants. They can make a proposal to the Director to hire postdocs and termed professors to help their research. The Director's approval on the proposed appointments will reflect the scientific vision and priorities set by the Director, who may	2) Decision-making system There is no change from the initial plan. The Director, being guaranteed an authority of making wide range of decisions, is making every effort to uplift the Institute by recruiting brilliant scientists from all over the world, and promoting the science of Institute both in scientific community and in public. For achieving the goal, the Director receives advice at different levels from the Executive Board Meeting, Scientific Advisory Board, and External Advisory Board. The Executive Board Meeting, consisting of the Director, two Deputy Directors, and the Administrative Director, is held regularly, typically once a week, to ensure smooth operation and swift decision making on daily matters. The members of this meeting also take an important role when the Director makes direct access to the office of the University President. The scientific Advisory Committee, consisting of T. Kohno, H. Ooguri, K. Saito, D. Spergel, T. Yanagida, gives advice to the Director on hiring scientific staffs and setting scientific strategies. The Director made final decision in all of hiring professors, associate professors, assistant professors, and postdoctoral fellows based on frequent consultation with the SAC. The External Advisory Board, appointed by the University President, reviews annually the scientific achievement and activities of the Institute and advises the President on scientific priorities and the research activities. They last met in November 2008, and presented favorable and encouraging comments about our achievement during the first half of JFY2008. The present

consult the SAC as needed. Of particular importance is the External Advisory Board (EAB) who will review annually the scientific achievement and activities of the Institute and advice the Director on the scientific priorities and the research activities to keep the Institute stay on the course of the proposed science. At least half of EAB members consist of scientists from institutes other than the University of Tokyo. 3) Allocation of authority between center director and host institution We have agreement with the Office of the President that except for the appointment of the Director and approval of appointments of PIs, the center Director has the authority to make a wide range of decisions from how to compose and organize the institute to how to operate it.	members are J. Ellis (CERN), M. Gonokami (U of Tokyo), N. Kaifu (NAOJ), Y.K. Kim (Fermilab/U of Chicago), S. Kojima (Tokyo Tech), D. Morrison (UC Santa Barbara), R. Peccei (UCLA; Chair), N. Reshetikhin (UC Berkeley/U of Amsterdam). 3) Allocation of authority between center director and host institution Based on an agreement with the office of the University President, the Director made final decisions in all of hiring new scientific and administrative staffs, distributing research fund among the staffs, finalizing the design of new center building.

5. Researchers and center staffs

i) “Core” to be established within host institution

Principal investigators

	At beginning	Planned for end of FY 2007	Final goal (Date: month, year)	Results at end of FY 2007	Results at end of FY 2008
Researchers from within host institution	10	10	10(Mar,2009)	10	10
Foreign researchers invited from abroad	5	5	7(Mar,2009)	5	5
Researchers invited from other Japanese institutions	5	5	5	5	5
Total principal investigators	20	20	22(Mar,2009)	20	20

All members

	At beginning	Planned for end of FY 2007	Final goal (Date: month, year)	Results at end of FY 2007	Results at end of FY 2008
Researchers <Number of foreign researchers among them and their percentage> [Number of female researchers among them and their percentage]	20 < 5, 25%>	68 < 14, 21%>	195(Mar,2011) < 69, 35%>	63 < 17, 27%> [1, 2%]	125 < 60, 48%> [7, 6%]
Principal investigators <Number of foreign researchers among them and their percentage> [Number of female researchers among them and their percentage]	20 < 5, 25%>	20 < 5, 25%>	22(Mar,2009) < 6, 27%>	20 < 3, 15%> [1, 5%]	20 <3, 15%> [1 , 5%]
Other researchers <Number of foreign researchers among them and their percentage> [Number of female researchers among them and their percentage]	0 < , %>	48 < 9, 19%>	173(Mar,2011) < 63, 36%>	43 <14, 33%> [0, 0%]	105 < 57, 54%> [6, 6%]
Research support staffs	0	10	20(Mar,2009)	10	22
Administrative staffs	3	10	10	7	11
Total	23	88	225	80	158

ii) Satellites

<Initial plan>

Institution (1)

The institute establishes an IPMU Kamioka satellite to promote closer collaboration with the neutrino group. It locates close to the Super-Kamiokande and KamLAND detectors. It gathers researchers who work on the underground experimental activities such as study of neutrino physics and XMASS, a new dark matter search experiment that has recently been funded. Two PI's, Professor Masayuki Nakahata of University of Tokyo and Professor Kunio Inoue of Tohoku University, will be stationed at the satellite and we will have researches jointly appointed from neutrino group.

One of the PI'S has already a grant with scientists at NAOJ to pursue the dark energy project. We also gather scientists from the world to conduct an analysis on the data from LHC. We have already a candidate for an associate professor.

-Role

-Personnel composition and structure

-Collaborative framework

<Results/progress/alternations from initial plan>

There is no alternation from the initial plan in our satellite approach. We, however, like to clarify what was written in the initial plan. In the initial plan, a statement about NAOJ and LHC were included in this section by a mistake. It should not have been included here. We set one and only one satellite which is at Kamioka.

Institution (1) IPMU Satellite

-Role

Kamioka laboratory has two ongoing neutrino experiments (Super-Kamiokande and KamLAND), and one dark matter search experiment (XMASS) which is under construction. IPMU tries to use Super-Kamiokande for detecting relic supernova neutrinos, and tries to detect neutrinoless double beta decay using KamLAND. IPMU joins construction and physics analysis of XMASS.

-Personnel composition and structure

The team from the Kamioka Observatory, ICRR, University of Tokyo, under Yoichiro Suzuki (also IPMU PI) and Masayuki Nakahata (also IPMU PI), consists of two professors, 3 associate professors, 7 assistant professors, and 3 postdoctoral fellows. The team from Research Center for Neutrino Science, Tohoku University, under Kunio Inoue (also IPMU PI), consists of 2 professors, 3 assistant professors, and 4 postdoctoral fellows. At IPMU, the relic neutrino team has 1 professor (Mark Vagins) and 1 postdoctoral fellow, the XMASS team has 1 associate professor (Kai Martens) and the neutrinoless double beta decay team has 1 distinguished postdoctoral fellow.

-Collaborative framework

IPMU members working at Kamioka Satellite work closely with members from other institutions for ongoing neutrino experiments of Super-Kamiokande and KamLAND. However, IPMU's main research objectives are to detect relic supernova neutrino at Super-Kamiokande, neutrinoless double beta decay at KamLAND, and dark matter at XMASS. Since these objectives still require considerable amount of R&D, close collaboration with other members is essential.

iii) Partner institutions

<Initial plan>

Institution (1)

1) National Astronomical Observatory in Japan (NAOJ)
(for dark energy survey and astronomy),

2) High Energy Accelerator Research Organization (KEK)
(for neutrino physics),

3) Department of Physics, Kyoto University (for neutrino physics), Department of Mathematics, Kyoto University (for mathematics) and Yukawa Institute for Theoretical Physics, Kyoto University
(for theoretical physics),

4) Department of Astrophysical Sciences, Princeton University in USA
(for dark energy survey and astronomy)

5) IHES (Institut des Hautes Études Scientifiques) in France
(for mathematics),

-Role

-Personnel composition and structure

-Collaborative framework

<Results/progress/alternations from initial plan>

We removed Department of Mathematics, Kyoto University which was on the initial list of partner institutions, as of April 2008. There is no other change on the list.

Institution (1) National Astronomical Observatory

-Role

Observation using the SUBARU telescope resulted in many important discoveries. NAOJ tries to move one big step further with improved instruments. One of the efforts, which is done in close collaboration with IPMU, is the investigation of dark energy.

-Personnel composition and structure

The NAOJ team consists of professor Hiroshi Karouji (leader), 1 associate professor, 2 assistant professors, and 3 postdoctoral fellows.

The IMPU team lead by PI, Ken'ichi Nomoto (IPMU) and PI, Hiroaki Aihara (Univ Tokyo) consists of 3 professors, 2 associate professors, 1 assistant professor, and 2 postdoctoral fellows.

-Collaborative framework

NAOJ and IPMU work closely for developing a wide-angle camera (HyperSuprimeCam) and data acquisition system for the SUBARU telescope with a particular emphasis on investigating the dark energy.

Institution (2) High Energy Accelerator Research Organization (KEK)

-Role

A team of phenomenologists at KEK develops schemes for examining the LHC data from the theoretical perspectives of the standard model (Higgs particle), beyond the standard model (SUSY particles, dark matter), and exotic phenomena (black hole, extra dimensions).

-Personnel composition and structure

The team lead by PI, Mihoko Nojiri, consists of one professor and 2 postdoctoral fellows.

-Collaborative framework

The IPMU phenomenology team tries to examine the LHC data more from the cosmology-inspired perspectives such as black hole and extra dimensions. However, that requires detailed understanding of the Higgs and SUSY sectors. Thus, it is mutually beneficial for KEK and IPMU to work in close collaboration. The Focus Weeks on LHC phenomenology were such effort.

Institution (3) Department of Physics, Kyoto University

-Role

Kyoto's neutrino group works with the Super-Kamiokande experiments for the measurements of neutrino oscillation. Particular emphasis is put on preparation for T2K experiment.

-Personnel composition and structure

The team consists of associate professor, Tsuyoshi Nakaya (leader), 1 assistant professor, 2 postdoctoral fellows.

-Collaborative framework

Kyoto team is heavily involved in the neutrino beam line at JPARC and a front detector of T2K experiment. IPMU team, on the other hand, puts more emphasis on Super-Kamiokande itself. Since a successful measurement of neutrino oscillation requires good understanding of all three systems, close collaboration of both teams is very important.

Institution (4) Department of Astrophysical Sciences, Princeton University

-Role

Princeton team has been providing essential contributions to a historical success of the WMAP project. At the same time, D. Spergel (leader) is a leading expert in both dark matter search and telescope design. The group works on developing a new type of wide-angle camera which will be installed in the SUBARU telescope and explore dark matter.

-Personnel composition and structure

The team consists of PI, David Spergel, 4 professors, 1 assistant professor, and 3 postdoctoral fellows.

-Collaborative framework

The group collaborates with the team lead by PI, Hiroaki Aihara, for constructing a wide-angle camera for the SUBARU telescope and investigation of the dark matter.

Institution (5) IHES (Institut des Hautes Etudes Scientifiques)

-Role

IHES is one of the leading research institutions in mathematics with strong connections to physics. We are negotiating for jointly hiring postdoctoral fellows. Their exchanges should promote closer interactions between mathematicians and physicists.

-Personnel composition and structure

At the moment, Institute Director Bourguignon and Field medalist Maxim Kontsevich are involved in collaboration with IPMU.

-Collaborative framework

Professor Bourguignon works closely with PIs, H.Ooguri and K. Saito on new developments in mathematics which are closely related to physics.

Institution (6) Yukawa Institute for Theoretical Physics, Kyoto University

-Role

The YITP has a long-standing record in the area of theoretical physics and mathematical physics at the very fundamental levels. A close collaboration is particularly beneficial in the area of string theory and quantum field theory.

-Personnel composition and structure

The team consists of Director Tohru Eguchi and associate professor Ken'ichi Izawa.

-Collaborative framework

Tohru Eguchi collaborates with PI, Hiroshi Ooguri in string theory, and Ken'ichi Izawa collaborates with PI, Tsutomu Yanagida, in particle theory.

Institution (7) Research Center for Neutrino Science, Tohoku University

-Role

The RCNS hosts the KamLAND experimental facility at Kamioka. The KamLAND experiment discovered an evidence for reactor anti-neutrino disappearance and observed clear signature of neutrino oscillation. It is trying to observe low-energy solar neutrinos. It also aims at detecting neutrinoless double beta decay in close collaboration with IPMU.

-Personnel composition and structure

The RCNS team lead by Kunio Inoue, who is also IPMU PI, consists of one professor, 3 associate professors, one lecturer, and 6 assistant professors.

-Collaborative framework

IPMU distinguished postdoctoral fellow, Alexandre Kozlov who stations at Kamioka Satellite, works with PI K. Inoue on R&D for the detection of neutrinoless double beta decay.

Institution (8) Department of Physics, University of California Berkeley

-Role

Particle theorists at Berkeley examine the LHC data from a wide range of theoretical perspectives such as Higgs particle, SUSY particles, and dark matter. More exotic possibilities such as black hole and extra dimensions are also on their agenda.

-Personnel composition and structure

The group consists of 1 professor, Lawrence Hall (leader), 1 associate professor, Yasunori Nomura, and 5 students.

-Collaborative framework

The team works closely with the IPMU Director, Hitoshi Murayama.

6. Summary of center's research environment

<Initial plan>	<Results/progress/alternations from initial plan>
1) Environment in which researchers can devote themselves to their research The Director will secure the funds to hire administrative staff and research support staffs to assure that researchers of the Institute be exempt from paper works associated with conducing researchers. In addition, for PI's from University of Tokyo, the Office of the President will provide resources that enable PI's to substitute their teaching duties in their original departments.	1) Environment in which researchers can devote themselves to their research Out of 33 administrative division staff (11 administrative staff and 22 research support staff), 16 are bilingual and 3 are with particle physics background. They successfully helped relocation of 17 newly arriving (since April 1, 2008) foreign staff members, of which 7 are with families. They handled the cases of 103 visitors from abroad, and hosted 7 international conferences. They also constructed an IPMU website in both English and Japanese with useful information for visitors and employees in both professional and daily living items. This work won the 2008 President's Award for operational improvement from the university.
2) Startup research funding Many of PI's of the Institute have already secured research fund by winning competitive grants. The Director will secure startup funds for young researchers and postdoctotal fellows hired by the Institute.	2) Startup research funding All postdoctoral fellows receive annual research fund of 500,000 yen from IPMU. Researcher at or above assistant professor rank receive startup fund according to their needs.
3) Postdoctoral positions through open international solicitations We will post all the job openings on major journals of the community such as Physics Today and will contact proactively via Emails leading scientists of the field, both in Japan and abroad, to solicit outstanding candidates.	3) Postdoctoral positions through open international solicitations We advertised for opening positions in Physics Today, CERN Courier, American Mathematical Society Magazine, American Astronomical Society Magazine, and in English IPMU homepage. We also sent the advertisements to numerous places worldwide via emails.
4) Administrative personnel who can facilitate the use of English in the work process In the fields of particle physics, mathematics and astronomy it has been the standard practice for researchers to speak English for work-related communication. We will assemble administrative staff members as well as research support members who are fluent in English with help from the Office of the President.	4) Administrative personnel who can facilitate the use of English in the work process At the moment, 16 out of 33 staff in the Administrative Division are bilingual. We established a system of using English in all work-related correspondences and announcements. We also constructed an IPMU website written in English.
5) Rigorous system for evaluating research and system of merit-based compensation	5) Rigorous system for evaluating research and system of merit-based compensation

Salary of the center director will be negotiated through the office of the President. Annual salaries for PI's will be decided by the Director. Salaries of researchers other than PI's will be decided by the Director with consultation to Deputy Directors. Evaluation of researchers will be strictly merit-based and will include citation counts, invited talks at international conference, cross-disciplinary papers, salaries at competing institutions abroad, and leadership roles at the Institute.	There is no change from the initial plan.
6) Equipment and facilities, including laboratory space, appropriate to a top world-level research center	6) Equipment and facilities, including laboratory space, appropriate to a top world-level research center
The University administration pledges to build a new building on Kashiwa campus for the Institute. The architecture will follow the style of Kavli Institute for Theoretical Physics at UC Santa Barbara and Center for Theoretical Physics at UC Berkeley with a large open area and amenities. It will provide an attractive and competitive environment for researchers from around the world. We plan to have a state-of-art video conference system and internet-blackboards among Kashiwa, Hongo, Komaba, Kamioka and other collaborating institutions that stay on 24hours a day, 7days a week to make impromptu discussions possible.	Construction of new IPMU building (5,900 square meters) has begun in January 2009 with an expected completing date set at October 2009. Construction of new Kamioka Satellite laboratory building (500 square meters) has begun in October 2008 and has been completed in February 2009. At the moment, our offices at Kashiwa campus are scattered around in the General Research Building (2 rooms on 6th floor and 2 rooms in the basement, total of 460 square meters) and 3 prefabricated temporary buildings behind it (total of 800 square meters). In order to cope with further need for office spaces, we secured additional 115 square meters office space in nearby Tokatsu Techno Plaza building starting February 2009.
7) International research conferences or symposiums held regularly to bring world's leading researchers together	7) International research conferences or symposiums held regularly to bring world's leading researchers together
Annual international conference at the Institute as well as long-duration workshops à la Kavli Institute for Theoretical Physics and Aspen Center for Physics will be held. They will bring in visitors to further stimulate the intellectual activities and keep the Institute at the forefront of worldwide science.	During the period between April 2008 and March 2009, IPMU hosted 7 international conferences (3 in mathematics and 4 in physics). Active exchange among researchers of mathematics and physics are now common occurrences at IPMU.
8) Other measures, if any	8) Other measures, if any
The University is constructing Kashiwa International Lodge that will be a main residential facility for foreign researchers who have moved to the Institute and short-term visitors. Meanwhile, the University will help the foreign researchers to find housings. The Institute's foreign affairs office will fully conduct the business related to foreign researchers together with the Office of the President.	Kashiwa International Guesthouse is scheduled to open in October 2009. To recruit top-level researchers from around the world, IPMU created an extensive section of the homepage describing working conditions and information about living in Japan. This web site has been hailed by Tokyo and Chunichi Shimbun as a unique attempt to lure foreign researchers, and

	won the 2008 President's Award from the university. IPMU has also gathered a group of volunteers who help foreign researchers to get registered at City Hall, create bank accounts, and find housing. We provide free Japanese classes (crash course) to make the transition easy.

7. Criteria and methods used to evaluate center's global standing

<Initial plan>	<Current assessment>
1) We introduce quantitative and objective methods to evaluate the Institute's global standing. The number of refereed journal papers, the number of citations of the papers the Institute researchers published, and the number of presentations our researchers deliver in the major international conferences will be kept monitored and tracked. These "numbers" form a base of evaluation of the center 's global standing. 2) The number of visitors and the number of foreign visitors among them are another objective indicator to measure the activity and visibility of the Institute. 3) In order to evaluate how effective the Institute is to bring mathematicians and physicists together, we plan to monitor the number of publications co-authored by mathematicians and physicists. It will be a measure of the synergy between the two disciplines. The proposed institute has already positioned itself as one of the most cited Institutions in Physics research. This is because all the principal investigators we assembled are leading scientists in their own discipline and the number of citations of each investigator is outstanding. Criteria 2 and 3 are, of course, yet to be applied. The goal to meet the criteria 1) is clear. We will maintain the statue of the most cited Institution in Physics and Mathematics. We aim to be one of the most visible research organizations in Physics and Mathematics.	1) During the period between April 2008 and March 2009, IPMU published 68 papers in refereed journals. We expect the number of publications increases greatly in near future since 148 preprints were written by IPMU members during the same period. 2) A total of 372 researchers have visited IPMU during this period, out of which 103 were from abroad. The number of long-term visitors of more than one month among them, excluding the joint appointees, amounted to 14 and 13 out of them were from abroad. 3) Five papers were written by IPMU members, authored by both mathematics and physics researchers.

8. Securing competitive research funding

<Initial plan>	<Results/progress/alternations from initial plan>
・ Indicate the total amount of research funding (e.g., competitive funding) secured by principal investigators who will join the center project. Itemize by fiscal year (FY2002-2006) taking into account the percentage of time each will devote to research activities at the center vis-à-vis the total time they spend conducting research activities ("Effort ②" in Appendix 2). For example, if this percentage is 70%, then 70% of his/her research funds can be counted in calculating the total amount of research funds. FY2002: $9.7M, FY2003: $10.9M, FY2004: $9.5M, FY2005: $13.2M, FY2006: $13.6M (in units of US dollars, Exchange Rate: JPY/USD=120) Grand total of competitive funding awarded to PI's over past 5 years is $56.9M. ii) Prospects after establishment of the center ・ Based on the past record, describe the concrete prospects for securing resources that match or exceed the project grant. ・ Calculate the total amount of research funding (e.g., competitive funding) based on the percentage of time the researchers devote to research activities at the center vis-à-vis the total time they spend conducting research activities ("Effort ②" in Appendix 2). Be sure the prospects are realistically based on the past record. Principal Investigators of the Institute have already secured competitive funding that amounts to approximately $55M, the same level as that of the past five years. We are, therefore, confident to maintain the same funding profile well into the era of this new Institute.	We secured $7.86M (using Exchange Rate JPY/USD=120) in FY2008.

9. Other important measures taken to create a world premier international research center

<Initial plan>	<Results/progress/alternations from initial plan>
- Describe activities and initiatives to be taken after project funding ends. We intend to keep the Institute as the advanced institute of the University, a permanent entity that belongs to the University. We plan to work, with the	- Describe activities and initiatives to be taken after project funding ends. We intend to keep the Institute as an advanced institute, which permanently belongs to the university. Obviously the most important approach for

Office of the President, to raise the fund.	achieving this goal is that the Institute makes profound contributions to the research field of physics and mathematics of the universe. Also important is to make the scientific community worldwide recognize that IPMU is indeed a place, where top level scientists want to gather. We are making continuous effort toward this goal. Other important point is to raise funds. We are working together with the office of the university president on this front.
・Describe expected ripple effects（e.g., how the proposed research center project will have trailblazing components that can be referred to by other departments in the host institution and/or other research institutions when attempting to build their own top world-level research centers）.	- Describe expected ripple effects（e.g. how the proposed research center project will have trailblazing components that can be referred to by other departments in the host institution and/or other research institutions when attempting to build their own top world-level research centers）.
We are confident that our aggressive approach to assemble the world-leading scientists from other institutions from within Japan or from abroad and our ambitious organization will have significant impact to the University. Also the merit-based evaluation system we introduce would be so attractive to young researchers that it could become a model that other institutions would follow.	We successfully recruited a large number of non-Japanese researchers. Our administrative staffs helped their relocation. They also established a procedure for describing the hiring contract, such as salary, tax and fringe benefits, the work-related information such as research grant, official traveling and responsibilities, as well as the living information such as schools and hospitals, in English. These descriptions are posted in our English website. We are receiving several requests for using them from other departments.
・Describe other important measures to be taken in creating a world premier international research center, if any.	- Describe other important measures to be taken in creating a world premier international research center, if any.
We will be proactive to raise funding for the Institute. In particular, we engage fundraising from the private sector both in Japan and abroad. In order to promote competitive atmosphere among PI's and senior researchers, we plan to institute a named distinguished professorship. It will be awarded by the Institute Director to an Institute professor after rigorous evaluation of his/her performance at the Institute.	We have approached Kavli Foundation to establish such named professorship. Currently the Japanese law that prohibits the University of Tokyo to invest in high-risk high-return funds is making Kavli Foundation hesitate.
If one or more of the projects applying for Global COE program have some connections with this research center project, list the project title(s) , outline(s), group leader(s) and the relationship(s) with this project.	- If one or more of the projects applying for Global COE program have some connections with this research center project, list the project title(s), outline(s), group leader(s) and the relationship(s) with this project.
Since the call for proposal of Global COE program for the disciplines related to the Institute, which are mathematics and physics, is scheduled for FY2008, there are no Global COE programs to list. Some of PI's, however, will definitely be involved in some of Global COE proposals that are under consideration. We as the Institute will seek close collaboration	Two proposals for the Global COE Program submitted by the IPMU Principal Investigators were approved. The grants started in JFY 2008 and continue for the next five years.

with such Global COE programs once they have been more developed and its relevance to the Institute has become more evident.	"Weaving Science Web beyond Particle-Matter Hierarchy" by Kunio Inoue, professor of Tohoku University, as a leader. They propose to establish an international research and education center to strengthen the understanding in each of the subjects that form a hierarchy of matter, starting from particles to nucleus, condensed matter, all the way to the universe, and to deepen the connection among them. Through this approach, they try to develop a new frontier of science. The leader of this project is a Principal Investigator of IPMU, and leading an effort in neutrino experiment at KamLAND. The theme for this program "Hierarchy of matter" can be considered as one aspect of the IPMU's theme "Physics and Mathematics of the Universe", and thus they are closely related to each other. "Quest for Fundamental Principles in the Universe" By Naoshi Sugiyama, professor of Nagoya University, as a leader. They propose to establish an international research and education center to study, i) evolution of the universe, ii) space-time structure of the particles and universe, and iii) physics of the cosmological environment. Their research objective "Fundamental Principle in the Universe" constitutes an important part of IPMU's objective "Physics and Mathematics of the Universe".

10. Host institution's commitment

<Initial plan>	<Results/progress/alternations from initial plan>
-Provision in host institution's mid-to-long-term plan The University of Tokyo's medium-term research objectives include "investigating exploratory and advanced research and unconventional research areas or actively approaching a new fusion of different academic fields with full respect for research schematization and succession, thereby playing a role to drive forward network-based research with a global perspective." The accompanying medium-term plan states that the university is dedicated to "promoting the establishment of a center for advanced research of excellent creativity and originality in new fields, while fostering the development of new academic areas through	-Provision in host institution's mid-to-long-term plan In the 2007 Progress Report, following statement was given. "A clear statement was added to the University of Tokyo's medium-term research objectives, saying "We give one of the highest priorities to the setting up of the World Premier International Research Center, Institute for the Physics and Mathematics of the Universe, for investigating the origin and evolution of the universe through close collaboration among mathematics, physics, and astronomy. In order to achieve the goal of the medium-term objectives, the university placed the IPMU directly under the office of the

interdisciplinary research and collaboration" and "in response to issues newly rising out of academic development and social changes, promoting the establishment of an international research center to deal with such issues in a pioneering, flexible, and practical manner beyond existing academic areas and organizational frameworks." In order to implement the medium-term plan mentioned above, the University of Tokyo has set up the Integrated Research System for Sustainability Science, the Network for Life Science Research, and other inter-departmental organizations under Office of the President to establish a system to promote multi-disciplinary research. Institute for the Physics and Mathematics of the Universe (IPMU), facilitated by the WPI Initiative, most appropriately meets the University's medium-term goals and plans, hence it shall be positioned as the largest and most important organization among those under Office of the President, and enjoy university-wide support under the specific achievement targets.	president as the highest priority cross-disciplined research center." There is no change since then.
-Concrete Measures	-Concrete Measures
(1) Competitive grants obtained by researchers participating in the project and in-kind contributions, etc. The University of Tokyo will position the IPMU as an organization directly under Office of the President working as a natural facilitator with existing university organizations. The Administration Bureau shall develop an ideal research environment to ensure that chief researchers engaged in research at the IPMU have minimum possible university duties to allow ample time for them to fully focus on research activities, and that research funding may be more readily secured. As part of developing such an environment, with the aim of securing excellent researchers as well as high-caliber support staff, a new employment scheme has already been implemented whereby it is even possible to recruit exceptionally qualified staff at salaries higher than that of the President. Priority is also given for the use of school research space. Furthermore, the Administration Bureau shall have an organization named the Financial Strategy Office whose task is to develop plans strategically to obtain external funding and to allocate it effectively. This shall allow the maximum financial support for the IPMU, while making full use of university resources including overhead costs for the program.	(1) Competitive grants obtained by researchers participating in the project and in-kind contributions, etc. In the 2007 Progress Report, following statement was given. “We secured a temporary space in Kashiwa where the researchers and staffs can conduct their activities until a new building is completed. We also set up the IPMU administrative division with 6 staffs within the Kashiwa campus administration department. This organization ensured a smooth startup of the institute. Financial Strategy Office, which was set up within the university administration, should also help to support the institute financially.” This year, the temporary office space in Kashiwa was expanded in order to cope with rapidly increasing researchers. The IPMU administrative division was expanded to have an administrative staff of 11 members.
(2) System under which the center’s director is able to make substantive	(2) System under which the center’s director is able to make substantive

personnel and budget allocation decisions The University of Tokyo has newly developed an innovative scheme to allow the positioning of the IPMU as an organization directly under Office of the President working in an organic linkage with existing university organizations. Under this scheme, the IPMU may take charge in the operation of the organization under the managerial supervision of the director of IPMU, including for the recruitment of researchers.	personnel and budget allocation decisions In the 2007 Progress Report, it was stated that the center's director is able to make all decisions including hiring of scientific staffs because the center is placed directly under the university president's office. There is no change to this policy.
(3) Support for the center director in coordinating with other departments at host institution when recruiting researchers, while giving reasonable regard to the educational and research activities of those departments In order to ensure that education and research activities may be implemented smoothly with no disturbance to the university faculties and institutions from which the researchers are gathered for the IPMU, the Administration Bureau shall provide any necessary financial support, such as for personnel expenses of substitute teaching staff, to the concerned university departments and divisions. This shall not only allow such departments and divisions to take measurements including securing substitute teaching staff, but the mobility of researchers within the university may be further improved.	(3) Support for the center director in coordinating with other departments at host institution when recruiting researchers, while giving reasonable regard to the educational and research activities of those departments In the 2007 Progress Report, we wrote that the university Administration decided to provide any necessary financial support for hiring substitute teaching staffs starting 2008. This year, the University Administration provided financial support for hiring one substitute teaching staff (assistant professor) per every two IPMU Principal Investigators who are faculty members of other departments and institute of the host institution. Also, the university Administration allocated a professor (or associate professor) position to the Department of Physics to help its faculty member (H. Aihara) concentrate on research activities at IPMU as a Principal Investigator (and Deputy Director), while giving minimum disturbance to the educational and research activities of the Department.
(4) Revamping host institution's internal systems to allow introducing of new management methods (e.g., English-language environment, merit-based pay, top-down decision making) unfettered by conventional modes of operation As described above, the University of Tokyo has developed an innovative scheme to allow positioning of the IPMU as an organization directly under Office of the President working as a natural facilitator with existing university organizations. Under this scheme, the IPMU may take charge in the operation of the organization under the managerial supervision of the director of IPMU, including for the recruitment of researchers, while new special regulations are also to be established designating the IPMU as a special zone in which participating researchers and support staff members	(4) Revamping host institution's internal systems to allow introducing of new management methods (e.g., English-language environment, merit-based pay, top-down decision making) unfettered by conventional modes of operation In the 2007 Progress Report, following statement was given. "Placing the center directly under the office of the university president made it possible for the director's management to make all decisions including hiring of scientific staffs. We also set up a separate salary scale to attract top class researcher from both Japan and abroad. Specifically, we adopt a system which guarantees the salary level of their previous positions, and can add incentives (for example, salary of the director, who

may be allowed a limited exemption from some restrictions under the work rules that are generally applied within the university.	held a professorship in US is sufficiently higher than his previous salary, and as a result, exceeds that of the university president). We adopt English as the official language and include that statement in our hiring advertisements." There is no change in these policies.
(5) Accommodation of center's requirements for infrastructural support (facilities, e.g., laboratory space; equipment; land, etc.) The University of Tokyo places great importance on the development of an environment to permit excellent researchers from overseas to steadily concentrate on their research activities. Currently, active initiatives to promote a more international campus are under way under the leadership of the President, and several residential facilities for foreigners are being developed near the campus and are due to open in a few years' time. Priority allocation of such residences for researchers invited to the IPMU from overseas has also been under discussion. The University also develops a number of world-class research facilities and actively promotes sharing the use of such facilities. Measures shall be taken to ensure the priority use of such research facilities. Top priority shall be given to the appropriation of land for a research building for the IPMU and its financing. Until the new research building is constructed in Kashiwa Campus, Chiba Prefecture, rooms and other space of the Kashiwa General Research Building shall be provided in priority for activities of the IPMU.	(5) Accommodation of center's requirements for infrastructural support (facilities, e.g., laboratory space; equipment; land, etc.) In the 2007 Progress Report, following statement was given. "We secured a necessary land in Kashiwa campus for a new research building, and decided that the university builds it. The building will be completed in 2009. Temporary space for the institute is already provided in Kashiwa campus, which will be further expanded by more temporary building in 2008." The construction of the building started in January 2009, and will be completed in October 2009. At the Kamioka Satellite, an office building has been completed in February 2009.
(6) Support for other types of assistance With the aim of supporting the establishment of an internationally competitive center through the program, the University of Tokyo has set up a committee headed by the board member in charge of the program. The committee, in addition to ensuring university-wide support for the IPMU, shall work in close cooperation with the Global COE (Centers of Excellence) Program and other schemes, as part of its role to produce maximum synergy. The administrative functions of the Administrative Bureau are to be reorganized in July 2007, where the Research Network Support Group is to be set up to intensively support the IPMU, among other organizations. With these schemes, the University shall provide the maximum possible consistent support for the promotion of the IPMU concept.	(6) Support for other types of assistance In the 2007 Progress Report, we stated: "President's Committee chaired by a board member supports creation of internationally competitive research center within the WPI program. This committee provides a university-wide support to IPMU, as well as close coordination with Global COE programs in order to maximize the synergy among various entities within the university. The university administration was restructured in July 2007, and Research Network Support Group was set up directly under the President's office. Using this new structure, the university provides a maximum and stable support to IPMU." This policy stayed the same through 2008.

11. FY 2008 funding

(Exchange Rate: JPY/USD=120)

Cost Items	Details	Costs (ten thousand dollars)
Personnel	Center director and Administrative director	48
	Principal investigators (no. of persons):12	140
	Other researchers (no. of persons):51	239
	Research support staffs (no. of persons):22	49
	Administrative staffs (no. of persons):10	53
	Total	529
Project activities	Gratuities and honoraria paid to invited principal investigators (no. of persons):30	37
	Cost of dispatching scientists (no. of persons):	0
	Research startup cost (no. of persons):23	10
	Cost of satellite organizations (no. of satellite organizations):1	65
	Cost of international symposiums (no. of symposiums):7	2
	Rental fees for facilities	14
	Cost of consumables	74
	Cost of utilities	4
	Other costs	118
	Total	324
Travel	Domestic travel costs	12
	Overseas travel costs	22

Dollars (Exchange Rate: JPY/USD=120)

WPI grant for FY 2008		1,173
Costs of establishing and maintaining facilities in FY 2008		758
Research building construction Advanced payment (Number of facilities: 5,800m²)	Costs paid:	608
Temorary Building (Number of facilities: ,500m²)	Costs paid:	59
New Kamioka Satellite laboratory building (Number of facilities: ,500m²)	Costs paid:	91
Cost of equipment procured in FY 2008		241
Equipment of removing radon and generating air: 1set	Costs paid:	52
High sensitivity gas analysis equipment: 1set	Costs paid:	34
High sensitivity gamma ray detection equipment: 1set	Costs paid:	42
Parallel-processing computer detection equipment: 1set	Costs paid:	14
Others		99

	Travel and accommodations cost for invited scientists (no. of domestic scientists):69 (no. of overseas scientists):138	45	
	Travel cost for scientists on secondment (no. of domestic scientists):6 (no. of overseas scientists):18	15	
	Total	94	
Equipment	Depreciation of buildings	4	
	Depreciation of equipment	36	
	Total	40	
Other research projects	Projects supported by other government subsidies, etc.	511	
	Comissioned research projects, etc.	53	
	Grants-in-Aid for Scientific Research, etc.	705	
	Total	1, 269	
Total		2, 256	

12. Efforts to improve points indicated as requiring improvement in follow-up review and results of such efforts

-Points specified as needing improvement	-Efforts to improve them and results
IPMU'S growing process is not without some difficulties. Most of the Japanese PIs are employed by other institutions or departments (Ken-nin). The duties imposed by their employment take priority over their IPMU activities, and they remain loyal to their home institutions. There are some indications that the director's voice is not heard by all the PIs. To build a laboratory with world-class theoretical activities, IPMU should hire a core of theoretical PIs and station them on the Kashiwa Campus, while making an effort to secure more full-time researchers, rather than Ken-nin positions. We also recommend that more effort be made to attract young foreign PIs to the Kashiwa Campus. To make IPMU a globally visible WPI research center, The University of Tokyo should devote effort to meeting the following imperatives: 1) Make every effort to reduce the lectures and administrative duties assigned to the PIs. 2) Allow IPMU members to take graduate students. 3) Take specific measures to integrate IPMU with the rest of the university. Otherwise, IPMU risks becoming isolated and thereby not able to achieve the transformative role that the WPI program intends centers to play at their host institutions.	A theoretical PI, Tsutomu Yanagida, has agreed to resign from University of Tokyo and be reappointed by IPMU as its full-time professor from April 2009. This will create a core group of theoretical physics on site. IPMU is making an effort to appoint a foreign PI in mathematics, which is currently under negotiation. To reduce the lectures and administrative duties assigned to the PIs, University has agreed to provide funds to hire assistant professors per every two PIs in their respective departments. In addition, President Komiyama has decided to provide two Associate Professor or Professor positions to IPMU. One of them will be attached to Department of Physics to substitute teaching of PI (and Deputy Director) Aihara. In order to allow IPMU members to take graduate students, negotiations have begun with Departments of Physics and Mathematics. Department of Physics has granted Director Murayama and associate professor Yoshida to take graduate students. Some of them will be encouraged to work with other members of IPMU. Department of Mathematics has granted PIs Saito and Tsuchiya to take graduate students. A similar arrangement will be made for Associate Professor Toda. Integration of IPMU into the University will require a long-term vision and lot of groundwork. The University administration is serious about it, yet concrete measures have not emerged yet. To merge mathematicians and physicists, there is a regular seminar series shared by string theorists and mathematicians. They are actively engaged in scientific discussions. IPMU also has appointed Kentaro Hori as a full professor. He has had a position at University of Toronto, a half each in mathematics and physics. His appointment will further boost the interactions between physicists and mathematicians. Prof. Maxim Kontsevich, a field medalist at IHES, has a track record to work at the interface between physics and mathematics. He is visiting IPMU regularly and help us achieve this goal. IPMU has purchased video conference equipments that can be used in seminar rooms. Some of the seminars by distinguished visitors are archived and posted on the web.

Others: In addition, the following are some opinions expressed by the program committee members. 1. As IPMU is starting from scratch, it should not be rushed to meet the same recruitment numbers as the other centers. 2. To advance collaboration among research institutions, Japan and MEXT need to create an environment that is conducive to one researcher being able to work at multiple research institutions. System reforms are needed in the area of personnel administration. 3. It may be very difficult, though important, to merge mathematicians with physicists. What is the Director's view on how to accomplish this? 4. It is recommended that IPMU deliver at least some of its seminars and other programs over the Internet/WWW (streaming video, Skype, etc.) so as to reach a broader audience and encourage more discussions with remote locations, including satellites, the rest of University, and worldwide institutions with similar interests. 5. It is important that IPMU be allowed to innovate so as to have a truly transformative effect on the university, and perhaps even on Japan.	Others: 1. We appreciate the committee's suggestion that we should not rush to meet the numerical goals. We put quality at the highest priority in our hiring decisions, especially at the faculty level. 2. The joint appointments will be extremely useful, both among different institutions and among different departments. University administration has been actively pursuing such possibilities. 5. We appreciate support from the committee. University administration has also been extremely supportive in this regard.