World Premier International Research Center Initiative (WPI)
FY2012 WPI Project Progress Report (Post-Interim Evaluation)

Host Institution	The University of Tokyo	Host Institution Head	Junichi Hamada
Research Center	Kavli Institute for the Physics and Mathematics of the Universe	Center Director	Hitoshi Murayama

Common instructions:
* Unless otherwise specified, prepare this report from the timeline of 31 March 2013.
* So as to base this fiscal year's follow-up review on the document "Post-interim evaluation revised center project," please prepare this report from the perspective of the revised project.
* Use yen (¥) when writing monetary amounts in the report. If an exchange rate is used to calculate the yen amount, give the rate.

Summary of State of WPI Center Project Progress (write within two pages)

Kavli IPMU is moving from the first phase of building the institute to the next phase of harvesting science. Even though the institute was launched from scratch, our impact factor is already comparable to world-leading institutes. Many of our observational and experimental activities have started to produce results after years of preparations.

Science and Interdisciplinarity

352 (347) papers were published in refereed journals during the FY 2012 (Calendar Year 2012), with a steady increase over the past years (13, 111, 202, 236, 252 for FY 2007 to 2011, respectively). The impact factor based on cumulative record since the inception to March 2013 shows the strength of our scientific output: 12.6 citations per paper and 44 papers with more than 50 citations. This data is based on Web of Science by Thomson Reuters, and we specifically excluded a particular review paper which has a huge citation number. Based on our study, this record is comparable to many world-leading institutions in our fields of astronomy, astrophysics, particle and fields, multidisciplinary physics, mathematics, applied mathematics. Our members are highly regarded; we received nine prizes or awards in a year alone.

The science results include the largest-ever three-dimensional map of massive galaxies and distant black holes, and the world best limit on the possible conversion between matter and anti-matter called neutrinoless double beta decay. The XMASS experiment looking for signature of dark matter underground also produced first scientific paper. These results bridge underground experiments and astrophysics.

We have realized our aspiration to join an accelerator-based particle physics experiment, Belle II at KEK, as proposed in the original proposal. It addresses the fundamental question about the origin of asymmetry between matter and anti-matter in the Universe, hence *why we exist*. Belle II collaboration accepted our group led by Associate Professor Takeo Higuchi, and we lead an international effort for assembling the Silicon Vertex Detector, the very heart of the experiment. The beam commissioning will start in 2015.

Hyper Suprime-Cam, a new 900M-pixel digital camera for Subaru Telescope, is now completed and under commissioning. The survey proposal is accepted in April 2013 for unprecedented 300 nights starting in February 2014. The design for the multi-object spectrograph, Prime Focus Spectrograph, for the follow-up spectroscopy has passed Preliminary Design Review, and is now ready for construction. For this international project for the combined large-scale survey dubbed SuMIRe, the PI is Director Murayama, and the science group leader is Professor Masahiro Takada, both at Kavli IPMU, involving both physicists and astronomers.

On the theoretical side, many interesting results appeared. For example, postdoc Melina Bersten and her collaborators showed that a yellow giant star can become a supernova under certain conditions, explaining

the mystery of missing progenitor for SN 2011dh. This interpretation was later confirmed observationally. Associate Professor Shinji Mukohyama, together with collaborators, improved limits on quantum gravitational effects by eight orders of magnitudes using IKAROS data on gamma-ray bursts. It is an excellent example how astronomical observation can constrain fundamental physical theories. Murayama and a student solved a 50-year-old puzzle how to count the number of gapless excitations and to understand their dispersion relations from spontaneous symmetry breaking, generalizing old results by Nambu and Goldstone. It employs presymplectic structure on homogeneous spaces, which is of mathematical interests, and has a wide range of applications from particle physics, astrophysics, nuclear physics, atomic physics, to condensed matter physics and material science.

Globalization

Our institute continues to be global. The membership at the end of FY 2012 is 44% non-Japanese. If only those paid by WPI funds are counted, it is even higher (65%). Our name recognition appears to be boosted by the Kavli association, and we received 887 (1347) applications to our positions in FY2012, of which 805 (1265) were from abroad (the numbers in the parentheses indicate the cumulative numbers of applications).

The globalization effort at Kavli IPMU aligns with and helps the overall globalization strategy of the University of Tokyo. For example, we played part in brokering an MOU between Princeton and Todai based on our ongoing collaboration on SuMIRe. Murayama was chosen to be the first of two instructors of online course (Coursera), which is already signed up by more than 20,000 students worldwide. We are a popular destination of JSPS-NSF student exchange program hosting 3 American students.

Organizational Reform

FY 2012 was the first year for the Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU), thanks to the approval by the WPI Program Committee. The motivation to bear Kavli name was two-fold: endowment and prestige. Because of the steady and flexible endowment income that can be carried over fiscal years, it already allowed us to overstretch our finances to go aggressively after postdoc candidates. The prestige factor is difficult to quantify, but it appears to have made a big splash within the community that a WPI institute was now recognized internationally with this donation. Comments made at the WPI exhibit during the AAAS convention showed that Kavli name was well appreciated by attendees. This is the first research center in Japan named after a donor of endowment, a symbol of system reform.

Given the new organizational structure of Todai Institutes for Advanced Study, which is allowed to request University resources, we were given our very first permanent position. We moved one of our core members to this position, the first concrete sign of a permanent institute. We are working closely with the University administration to increase this number over time.

In order to build a more stable management, we appointed Professor Nobuhiko Katayama from KEK to the Associate Director, a new position to aid Director Hitoshi Murayama. We also successfully appointed our first female on-site faculty member, Assistant Professor Alexie Leauthaud, a well-known expert on mapping dark matter distribution in the Universe, despite a competing tenured offer from Portsmouth.

Seeing the successful model of Murayama and others, University of Tokyo implemented cross-appointments with other institutions as well as merit-based salaries in limited cases starting this April.

Outreach

We continue to make a vigorous effort in public outreach. Our public lecture series mobilized more than 17,000 (6,300) people and we had more than 800 (170) media coverages so far (FY 2012). Our members published a number of popular science books, printed more than 670,000 copies altogether.

・Please concisely describe the progress being made by the WPI center project from the viewpoints described below.
・In addressing the below-listed 1-6 criteria, please place emphasis on the following:
(1) Whether research is being carried out at a top world-level (including whether research advances are being made by fusing fields).
(2) Whether a proactive effort continues to be made to establish itself as a "truly" world premier international research center.
(3) Whether a steadfast effort is being made to secure the center's future development over the mid- to long term.
・Please prepare this report within 10-20 pages (excluding the attached forms).

1. Conducting research of the highest world level

* Regarding the criteria used when evaluating the world level of center, please note any updated results using your previous evaluation criteria and methods or any improvements you have made to those criteria and methods.

The Sloan Digital Sky Survey III (SDSS-III) team, including Kavli IPMU assistant professors Kevin Bundy and Alexie Leauthaud, Director Hitoshi Murayama, and affiliated member Brice Ménard, has released the largest-ever three-dimensional cosmic map, as Data Release (DR) 9. At the beginning of 2011, SDSS-III released the largest digital color image of the sky ever made. SDSS-III started a six-year plan to extend this image to a 3-dimensional map, and with online release of DR9, the first one third of the cosmic map has been made available.

Neutrinoless double beta decay is one of the clues to solve the mystery: *why is our universe made of matter?* Or *why almost no antimatter exists in our universe?* KamLAND-Zen is an experiment to search for neutrinoless double beta decay in Xenon 136 and its detector is located 1000 m underground in the Kamioka mine. The international team led by Kavli IPMU PI Kunio Inoue (also Director of the Research Center for Neutrino Science, Tohoku University) and including Assistant Professor Alexandre Kozlov published the world best limit for the neutrinoless double beta decay half-life of 1.9×10^{25} years at 90% Confidence Level. The combined result from KamLAND-Zen and another ^{136}Xe neutrinoless double beta decay search experiment EXO-200 (lower limit for the ^{136}Xe neutrinoless double beta decay half-life of 3.4×10^{25} years at 90% CL) refutes the "discovery" of neutrinoless double beta decay in ^{76}Ge, previously claimed by a part of the Heidelberg-Moscow Collaboration, at more than 97.5% CL.

The XMASS experiment looking for signature of dark matter underground also produced first scientific paper. Using the entire 835 kg inner volume as target, the analysis threshold can be lowered to 0.3 keVee (electron-equivalent) to search for light dark matter. With low threshold data corresponding to a 5591.4 kg ･day exposure of the detector and without discriminating between nuclear-recoil and electronic events, XMASS excluded part of the parameter space favored by other experiments.

These results bridge underground experiments and astrophysics.

We have finally realized our aspiration to join an accelerator-based particle physics experiment, Belle II at KEK, as proposed in the original proposal. It addresses the fundamental question about the origin of asymmetry between matter and anti-matter in the Universe, hence *why we exist*, through precise study of CP violations. Also, study of B-meson decays is a natural place to investigate a wide range of the Flavor-Changing Neutral Current (FCNC) processes because the b quark belongs to the third generation and hence its decay is involved with all existing generations of quarks. Flavor physics has provided several critical

breakthroughs in the history of establishing the Standard Model. Powerfulness of flavor physics to elucidate physics beyond the Standard Model should be fully exploited, and this situation would be even more true after energy frontier machines discover new particles. Belle II collaboration accepted our group led by Associate Professor Takeo Higuchi, and the Kavli IPMU team leads an international effort for assembling the Silicon Vertex Detector, which is used to measure the decay vertices of B-mesons with high resolution, and therefore it is the very heart of the experiment. Success of the Belle II experiment heavily relies on our responsibility. The beam commissioning will start in 2015 and data taking in 2016.

SuMIRe (Subaru Measurement of Image and Redshifts) is a large-scale international survey project aiming at uncovering the origin and future of the universe. This project is led by Director Murayama as a core researcher (PI) and the science group leader Professor Masahiro Takada, both at Kavli IPMU, involving both physicists and astronomers from the Academia Sinica Institute for Astronomy and Astrophysics (ASIAA, Taiwan), Jet Propulsion Laboratory of NASA, California Institute for Technology, Princeton University, Johns Hopkins University, Laboratoire d'Astrophysique Marseille, Universidad São Paulo, and the Laboratório Nacional de Astrofísica (LNA, Brazil). It is one of the research projects selected by CSTP (the Council for S&T Policy, Cabinet Office of Japanese Government) and supported by FIRST (the Funding Program for World-Leading Innovative R&D on Science and Technology). A wide-field imaging camera Hyper Suprime-Cam, a new 900M-pixel digital camera for Subaru Telescope, is one of the two subprojects of SuMIRe. It is now completed and under commissioning. The survey proposal is accepted in April 2013 for unprecedented 300 nights starting in February 2014. The design for the multi-object spectrograph, Prime Focus Spectrograph (PFS), another subproject of SuMIRe for the follow-up spectroscopy, has successfully passed Preliminary Design Review, and is now ready for construction. The PFS will also be mounted on the Subaru Telescope, and it will be used to investigate the nature of dark energy, the evolution of galaxies, the assembly history of the Milky Way and Andromeda galaxies, and so on.

On the theoretical side, many interesting results appeared. For example, postdoc Melina Bersten and her collaborators including Ken'ichi Nomoto, Gaston Folatelli, and Keiichi Maeda of Kavli IPMU showed that a yellow giant star can become a supernova under certain conditions, explaining the mystery of missing progenitor for SN 2011dh. The group presented evidence that a yellow supergiant (YSG) star found at the location of supernova SN 2011dh in the famous nearby galaxy M51 was indeed the star that exploded. The study of YSG progenitors had been controversial because they could not easily fit the theory of stellar evolution. However, a confirmation on this topic came in March 2013 with an announcement of the disappearance of a YSG star in images collected by the Hubble Space Telescope (HST) after the SN faded sufficiently. Bersten and collaborators have also predicted that the explosion should leave behind a very blue star that was the binary companion of exploded YSG. Their efforts now aim at confirming the proposed model by detecting the blue companion in future HST observations.

Associate Professor Shinji Mukohyama, together with collaborators, improved limits on quantum gravitational effects by eight orders of magnitudes using the data of JAXA's small solar power sail demonstrator "IKAROS" spacecraft on gamma-ray bursts (GRBs). They measured linear polarization in the gamma-ray emissions of distant GRBs at the most precise levels to date, using the "GAP (GAmma-ray burst Polarimeter)" on board IKAROS, and they found that the polarization did not rotate during its journey, as long as several billion light years. Some quantum gravity theories such as superstring theory predict that structures of space-time at extremely short distances may be totally different from what we think we know, and they predict a possible violation of CPT, which is one of the most fundamental symmetries. Previous

measurements indicated that nature obeys CPT at least to a level of one part in 10 million. The new result leads to the most stringent constraint on CPT violation, a level of one part in 10^{15}, i.e., an improvement of 8 orders of magnitude over the previous limits. This result implies that a fundamental symmetry CPT is not violated at extremely small distances which quantum gravity theories deal with.

Director Murayama and a student solved a 50-year-old puzzle how to count the number of gapless excitations and to understand their dispersion relations from spontaneous symmetry breaking, generalizing old results by Nambu and Goldstone. It employs presymplectic structure on homogeneous spaces, which is of mathematical interests, and has a wide range of applications from particle physics, astrophysics, nuclear physics, and atomic physics, to condensed matter physics and material science. Continuous symmetries produce gapless Nambu-Goldstone bosons that govern the phenomena at long wavelengths and small energies. Yet there is a variety in the spectrum of gapless excitations even when the symmetry breaking patterns are the same. However, the original Nambu theory proposed in 1961 was constructed in the framework of a quantum field theory for elementary particles, assuming their interactions in vacuum at absolute zero temperature, and hence Lorentz-invariant. Therefore, this theory cannot be directly applied to the Lorentz-non-invariant cases with finite temperature and density. Then, truly basic questions, such as the number of Nambu-Goldstone bosons or their dispersion relations, had been studied only on case-by-case basis without a general framework. Murayama and his collaborator Haruki Watanabe proposed a framework to understand Nambu-Goldstone bosons in a unified way by representing all known examples in a single-line Lagrangian of the low-energy effective theory, thus extending the Nambu-Goldstone theorem to Lorentz-non-invariant systems. This result applies to all dynamical systems subject to spontaneous symmetry breaking, under the assumption made, namely, there are no gapless excitations other than Nambu-Goldstone bosons. In particular, it is the first result showing the implications of spontaneous symmetry breaking on the low energy spectrum in general, and is applicable to non-relativistic systems of interest in condensed-matter physics. This paper has been chosen for "Editors' Suggestion" in Physical Review Letters and "exceptional research" by American Institute for Physics.

In FY 2012, Kavli IPMU hosted 11 workshops and held 232 seminars. Research activities at Kavli IPMU have resulted in 352 (347) papers published in refereed journals during FY 2012 (Calendar Year 2012), with a steady increase over the past years (13, 111, 202, 236, 252 for FY 2007 to 2011, respectively). The impact factor based on cumulative record since the inception to March 2013 shows the strength of our scientific output: 12.6 citations per paper and 44 papers with more than 50 citations. This data is based on Web of Science by Thomson Reuters, and we specifically excluded a particular review paper which has a huge citation number. Based on our study, this record is comparable to many world-leading institutions in our fields of astronomy, astrophysics, particle and fields, multidisciplinary physics, mathematics, and applied mathematics.

2. Advancing fusion of various research fields

In order to encourage interdisciplinary research, Kavli IPMU has been regularly holding joint seminars of different fields. There are three kinds of these joint seminars: 48 mathematics-string theory seminars and 110 astronomy-cosmology-particle physics seminars have been held in FY 2012. In addition, we have started mathematics-astronomy seminar in fall 2011 to enhance the collaboration between mathematicians and astronomers to develop new mathematical approaches in the gravitational lensing analysis and extract

maximum amount of information from the data. We also specifically designate select colloquia as "interdisciplinary" meant for the entire institute. It is a result of trial-and-error after a few years to provide common grounds for all members on important topics. For example, on April 24, 2013, Tsutomu Yanagida discussed Higgs boson after its confirmation on March 14, 2013. It was highly appreciated by all members.

An interdisciplinary collaboration between string theorists at Kavli IPMU (Hirosi Ooguri) and condensed-matter physicists at ISSP (Masaki Oshikawa) emerged from Focus Week "Condensed Matter Physics Meets High Energy Physics" which was jointly organized by IPMU and ISSP in February 2010. Condensed-matter physics often provides the realization of intriguing theoretical concepts, which originate, but are rather difficult to observe experimentally, in high-energy physics. Their joint work on "Instability in Magnetic Materials with a Dynamical Axion Field" has borne a fruit; a paper has been published in Physical Review Letters in February 2012. While the axion is a possible component of dark matter, direct detection of the hypothetical particle so far remains elusive. However, when there is an antiferromagnetic order in an insulator, the magnetic fluctuations can couple to electrons, playing the role of the dynamical axion field. Interesting effects due to the dynamical axion field were predicted in the presence of an applied magnetic field. Such a system is called "topological magnetic insulator," and it gives a condensed-matter realization of the axion electrodynamics. This paper was selected for Editors' Suggestion "based on the potential interest in the results presented and, importantly, on the success of the paper in communicating its message, in particular to readers from other fields."

Kavli IPMU has hosted several interdisciplinary workshops. Recently, there has been intriguing and fruitful interaction between the field of homological algebra and algebraic geometry (mathematics) and that of two-dimensional quantum gauge theories (physics). Gauge theory provides mathematical predictions, such as equivalence of derived categories, and they are sometimes proven in algebraic geometry. On the other hand, development in homological algebra leads to discovery in physics, such as new duality in quantum gauge theory as well as physical way to understand equivalence of categories. To bring together some of the key players and to provide a place to promote the interaction further, Workshop "Homological Projective Duality and Quantum Gauge Theory" was organized. Another Workshop "Geometry and Physics of the Landau-Ginzburg Model" dealt with an important model in the study of supersymmetric quantum field theory and superstring theory. Recently, a great deal of mathematical progress is being made in various aspects related to this model, such as mirror symmetry, the Landau-Ginzburg/Calabi-Yau correspondence, gauged LG models, higher genus A and B-models, and connections to integrable hierarchies. This workshop brought together many of the key players and provided a place to interchange ideas and learn about the most important advances. Kavli IPMU-FMSP Tutorial Workshop "Geometry and Mathematical Physics" was attended by about 50 participants, mostly young researchers and graduate students. They were able to hear systematic introductory lectures for subjects of current interests, which are related to both mathematics and theoretical physics. It was a stimulating and precious occasion for students and young researchers working in mathematics and physics.

Kavli IPMU also hosted several workshops dealing with common problems in particle physics and cosmology, such as Focus Week "Gravity and Lorentz Violations" and Workshop "Supernovae, Dark Energy, and Cosmology."

3. Globalization of the institution

* Describe what's been accomplished or recognized in the efforts to raise the center's international recognition as a genuine top world-level research institute, along with innovative efforts proactively being taken in accordance with the development stage of the center, including the following points, for example:
  - Efforts being developed based on the analysis of number and state of world-leading, frontline researchers; number and state of visiting researchers; exchanges with overseas entities
  - Proactive efforts to raise the level of the center's international recognition
  - Efforts to make the center into one that attracts excellent young researchers from around the world (such as efforts fostering young researchers and contributing to advancing their career paths)

  - Efforts being developed based on the analysis of number and state of world-leading, frontline researchers; number and state of visiting researchers; exchanges with overseas entities

From the development stage, we had a firm belief that a key to gain the international recognition is to bring top-level leaders and talented young researchers from around the world, and to create an environment in which researchers of different fields learn each other's languages and work together toward common goals. All 18 Principal Investigators (4 foreign) are world top-level scientists. A large fraction of our researchers is foreign and many in the senior-level are also considered as world top-level. Out of 236 member researchers including affiliate members, long-term visitors and graduate students, 105 (44%) are foreign. If we count the number of researchers paid by WPI funds, out of 64 researchers 42 (65%) are foreign. Also, we were visited by 602 (831) researchers, of which 404 (495) were foreign (the numbers in the parentheses indicate the cumulative numbers of people). Many of them are also world top-class scientists.

Kavli IPMU has MOU in effect in FY 2012 with 12 foreign institutions and consortia (5 in the US, 4 in Europe, 2 in Asia and 1 in South America).

The globalization effort at Kavli IPMU aligns with and helps the overall globalization strategy of the University of Tokyo. For example, we played part in brokering a university-wide MOU between Princeton University and the University of Tokyo based on our ongoing collaboration on SuMIRe.

- Proactive efforts to raise the level of the center's international recognition

Kavli IPMU hosted 11 workshops and conferences. Among the 542 participants in total, 175 were from foreign institutions. The subjects that were covered in these meetings and the speakers were carefully selected so as to keep the timeliness of topics and the discussion of highest quality. At the same time, Kavli IPMU researchers presented numerous talks and seminars at both foreign and domestic institutions and conferences. These activities helped to raise the visibility of Kavli IPMU in the international community.

- Efforts to make the center into one that attracts excellent young researchers from around the world (such as efforts fostering young researchers and contributing to advancing their career paths)

Kavli IPMU has a policy that all full-time researchers have to spend at least one month abroad each year and that they are allowed to do so up to three months. This policy provides an ample opportunity, especially for young members, to expose themselves by giving talks at conferences and seminars abroad. This greatly helps them to raise their visibility in the international community and opportunity for subsequent career developments. The hiring for fall 2013 started from winter 2012, synchronized with the US and European schedule. We received 887 (1347) applicants, of which 805 (1265) were from abroad (the numbers in the parentheses indicate the cumulative numbers of applications).

In FY 2012, the University of Tokyo has signed an agreement to deliver courses through online education provider Coursera, a rapidly-growing Massive Open Online Course (MOOC) provider that offers courses online for anyone to take, for free. Director Murayama was chosen to be the first of two instructors of course to be provided by the University of Tokyo, which is already signed up by more than 20,000 students worldwide.

Also, Kavli IPMU is a popular destination of JSPS-NSF student exchange program. In FY2012, we have hosted 3 American students.

4. Implementing organizational reforms

* If innovated system reforms generated by the center have had a ripple effect on other departments of the host institutions or on other research institutions, clearly describe in what ways.

FY 2012 was the first year for the Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU), thanks to the approval by the WPI Program Committee. The motivation to bear Kavli name was two-fold: endowment and prestige. Because of the steady and flexible endowment income that can be carried over fiscal years, it already allowed us to overstretch our finances to go aggressively after postdoc candidates. The prestige factor is difficult to quantify, but it appears to have made a big splash within the community that a WPI institute was now recognized internationally with this donation. Comments made at the WPI exhibit during the AAAS convention showed that Kavli name was well appreciated by attendees. This is the first research center in Japan named after a donor of endowment, a symbol of system reform. For the University of Tokyo, of course, there has been no previous experience to have accepted endowment from a foreign foundation, so that it provided an opportunity for the University of Tokyo to reexamine and reform the systems for managing donated funds.

Given the new organizational structure of Todai Institutes for Advanced Study, which is allowed to request University resources, we were given our very first permanent position. We moved one of our core members to this position, the first concrete sign of a permanent institute. We are working closely with the University administration to increase this number over time.

5. Efforts to secure the center's future development over the mid- to long term

* Please address the following items, which are essential to mid- to long-term center development:
  - Future Prospects with regard to the research plan, research organization and PI composition; prospects for the fostering and securing of next-generation researchers
  - Prospects for securing resources such as permanent positions and revenues; plan and/or implementation for defining the center's role and/or positioning the center within the host institution's institutional structure
  - Measures to sustain the center as a world premier international research center after program funding ends (including measures of support by the host institution)

- Future Prospects with regard to the research plan, research organization and PI composition; prospects for the fostering and securing of next-generation researchers

Our basic research plan stays the same as originally envisioned. Namely, we address the most fundamental questions of the universe by conducting experimental explorations from underground, into the sky and at the accelerator, and tie them together using common threads of theoretical physics, mathematics and instrumentation. However, as mentioned already, we have finally realized our aspiration to join an

accelerator-based particle physics experiment, Belle II at KEK, as proposed in the original proposal. It is also planned to join an accelerator long baseline neutrino oscillation experiment T2K (Tokai-to-Kamioka) for precise study of neutrino mixing by means of neutrino oscillations. Further, considering the start of the SuMIRe project that expands the scope of the large-scale galaxy survey, and flourishing mathematics activities at Kashiwa campus far beyond our original expectation, our future prospects are even brighter than originally anticipated.

Our research organization is also essentially the same as the original one, in which research is conducted in a loosely-bound flat structure with the Principal Investigators taking leadership roles. In order to build a more stable management, however, we appointed Professor Nobuhiko Katayama from KEK to the Associate Director, a new position to aid Director Hitoshi Murayama. We also successfully appointed our first female on-site faculty member, Assistant Professor Alexie Leauthaud, a well-known expert on mapping dark matter distribution in the Universe, despite a competing tenured offer from Portsmouth.

- Prospects for securing resources such as permanent positions and revenues; plan and/or implementation for defining the center's role and/or positioning the center within the host institution's institutional structure

The university of Tokyo administration agreed to provide Kavli IPMU with 9 president's discretion tenure positions by the end of FY 2016. Already we have secured 3 such positions (as already mentioned, one of these positions is a permanent position allocated to TODIAS).

The FY 2010 creation of TODIAS provides a permanent place for Kavli IPMU within the university. The university has been extremely supportive for creating a scheme to permanently support Kavli IPMU within the framework of TODIAS. So far, the university is committed to permanently sustain Kavli IPMU with 100% outside funding as long as such fund is secured by us.

- Measures to sustain the center as a world premier international research center after program funding ends (including measures of support by the host institution)

The university is making a serious effort to make more flexible system of human-resource-management so that it can support Kavli IPMU for a limited period in the event Kavli IPMU cannot sustain itself with external funds only.

6. Others

* In addition to the above 1-5 evaluation items, only if there is anything else that deserves mention regarding the center project's progress, please note it.

We continue to make strong effort in public outreach. Our public lecture series mobilized more than 17,000 people so far. We had more than 800 times of media coverage cumulatively. Restricting to FY 2012, the numbers were 6,300 and 170, respectively. Our members published a number of popular science books, printed more than 670,000 copies altogether.

7. Center's response to the results of the FY2012 follow-up (including the results of the site visit)

* Note how the center has responded to the results of FY2012 follow-up. However, if you have already

provided this information, please indicate where in the report.

(from FY2012 follow-up)

4. Actions Required and Recommendations

1) The very large breadth of Kavli IPMU research topics show the ambitions and energy of all players. Nevertheless for the next phase, a certain focus could be appropriate to build a critical mass.

We have started discussing this issue inside Kavli IPMU, and are waiting for the written report from the External Advisory Committee held in June 2013. We are planning to present our point of view on this matter to the Working Group at the next site visit. We will emphasize the synergies among different research topics that go beyond the sum of the parts.

2) The limited duration of the WPI program provides some difficulties in hiring new ones or in keeping top-notched researchers when they are offered steady positions.

This is very true. In fact, we anticipate few more departures coming because of their fixed terms. On the other hand, the decision for the five-year extension expected in fall 2014 greatly reassured most of our members to stay for now because they will have two hiring cycles left if no extension will be granted. For recruiting, based on the recommendations by the WPI program committee to consider more joint appointments, we successfully hired Mark Hartz as an assistant professor, which can be backstopped by TRIUMF (Canadian national laboratory) beyond 2017 after review. We need to keep improving new schemes like this for successful recruitments.

3) Neverthless, departure of young scientists is in a sense unavoidable when really talented scientists have been hired, indicating that the center is becoming a step board for young scientists' career. Some cleaver management scheme is necessary to sustain the WPI activity in spite of the loss of talents.

This is very true. The most pressing aspect is to maintain the "core" team that can recruit more junior scientists who come and go. Right now we do not have a stable "core."

4) With the establishment of TODIAS, UT is in a position to give a certain number of tenured positions to IPMU, but the given access to a few positions is not sufficient enough. Joint appointments of professors with both Japanese or foreign institutions should be pursued.

As a part of the systemic reform of the personnel management, the University of Tokyo has decided to allow officially cross appointments of its faculty members with other institutes. However, no clear policy has been set about joint appointments within the university. Nevertheless, we will try to expand joint appointments of professors with both Japanese or foreign institutions, and have started negotiations with Faculty of Science and Faculty of Mathematical Sciences. Note also the example with TRIUMF mentioned under 2).

5) Efforts to secure permanent resource beyond WPI are necessary for the longer term.

The only permanent resource we have secured so far is annual income from the $7.5M endowment fund created by the The Kavli Foundation. The Kavli Foundation and the University of Tokyo agreed to collaborate in expanding this fund to $20M in future. We will also make efforts to secure other permanent resources by some other means though it is not easy.

6) Rapid presentation of protocol and roadmap for the 5-years extension under the WPI program is desireable.

We have been discussing this matter with the University of Tokyo management. We will present our concrete plan in due course.

(from Site Visit Report)

6. Actions to the comments raised by the program committee

Most of the comments have been seriously received and genuine effort was made to act on the comments. We are especially pleased to find that an associate director was hired with one of the four tenured position offered by UT. On the other hand, there are some unresolved issues:

(1) The number of Japanese postdocs did not improve very much. Only one was hired during FY 2011.

Kavli IPMU is adopting a global standard for the hiring process of researchers. This process starts with the job opportunity announcement in the fall, and through the screening process jobs are offered in winter. We seriously took this recommendation, and we have offered postdoctoral positions to several Japanese candidates. Through these efforts, we hire three Japanese postdocs on April 1, 2013. In addition, we decided to accept actively JSPS Japanese postdoctoral fellows to Kavli IPMU. As a result, six those postdocs including four particle physics theorists come to Kavli IPMU starting with April 1, 2013.

(2) Number of women researchers has not improved.

In FY2012, Alexie Leauthaud, previously Kavli IPMU postdoc, was appointed as a project assistant professor. In addition, it is worth pointing out that in FY2012, one woman postdoc (Johanna Knapp) moved out, while three women postdocs (Claire Lackner, Anupreeta More, and Benedetta Vulcani) were hired. In sum, the number of woman faculty members has been increased by one, and the number of women researchers has been increased by two in FY2012. However, we have still only one woman PI (Mihoko Nojiri). We will continue our efforts to search for a new woman PI and to increase the number of women faculty members as well as the number of women researchers.

(3) Issue of Japanese Kennin problem has not been solved.

As a part of the systemic reform of the personnel management, the University of Tokyo has decided to allow officially cross appointments of its faculty members with other institutes. However, no clear policy has been set about joint appointments within the university. Nevertheless, we believe the *Kennin* problem will be solved in near future.

8. Actions required and recommendations

The WG hopes to see definite action on 3 items pointed out in 6. In addition, we have the following recommendations:

To Kavli IPMU

(1) One hallmark of the Kavli IPMU is its breadth of research topics. This is a good thing. For the next phase in the evolution of the Kavli IPMU, however, we might nevertheless suggest to attempt to define certain focus areas, in order to bundle the efforts of its scientists, to build "critical mass", and to develop certain "trademark activities" where the Kavli IPMU could attempt to evolve from a world-class player and become a world leader.

The same answer to *the Actions Required and Recommendations (1) of the FY2012 follow-up*: We have started discussing this issue inside Kavli IPMU, and are waiting for the written report from the External Advisory Committee held in June 2013. We are planning to present our point of view on this matter to the Working Group at the next site visit.

(2) In its future hiring, perhaps special attention should be given to candidates in mathematics who show signs of interest in physics, and vice versa.

We will take note of this recommendation, and have started an active discussion on the near-future hires with this recommendation in mind.

(3) The job security is not the only obstacle for retaining good faculty and keeping them from leaving. Full or associate professors of high quality deserve to have a chance to take a leadership role in their research group – if she/he wishes. They should be given power and influence in hiring postdocs as well.

We have started discussing this issue inside Kavli IPMU, but no definite conclusion has been reached yet. We observed conflicts between two central ideas to WPI: ideal research environment without duties, and leadership and managerial roles within the institute. We feel especially reluctant to give duties to those without tenure. We are planning to present our point of view on this matter to the Working Group at the next site visit.

(4) The age gap among mathematicians between the very young and old should be addressed with urgency.

We have been trying to hire a new foreign mathematician as a PI, using a President's discretionary

position. However, systemic issues concerning salary levels on such a position as well as employment beyond the age of 65 are hampering our effort. We just started a discussion on an alternative possibility using joint appointments with Faculty of Mathematical Sciences.

(5) The WG suggests Kavli IPMU to increase the number of on-site PIs by creatively defining the PI position.

We have started discussing this issue inside Kavli IPMU, but no definite conclusion has been reached yet. Again we observed conflicts between two central ideas to WPI: ideal research environment without duties, and leadership and managerial roles within the institute. We feel especially reluctant to give duties to those without tenure. However, we would like to point out that our "faculty members" all have complete academic freedom and very much act just like "PIs" at other centers. We are planning to present our point of view on this matter to the Working Group at the next site visit.

(6) Unfortunately administrative director, Dr. Nakamura wishes to leave. Special care in his replacement is important for the future of Kavli IPMU.

From the beginning of FY2013, Dr. Tomiyoshi Haruyama, former Deputy Director of Institute of Particle and Nuclear Studies at KEK, takes over Dr. Kenzo Nakamura's position. Dr. Haruyama is a world renowned researcher in cryogenics and superconductivity, having worked long for high-energy physics applications, and has ample experience of administration. Therefore, he is very suitable for administrative director of Kavli IPMU. Dr. Nakamura will remain at Kavli IPMU at least for one year, and will make administrative advice as needed.

List of Center's Research Results and Main Awards

A. Refereed Papers

List only the Center's papers published in 2012. (Note: The list should be for the calendar year, not the fiscal year.)

(1) Divide the papers into two categories, A and B.

A. WPI papers
List papers whose author(s) can be identified as affiliated with the WPI program (e.g., that state the name of his/her WPI center). (*Not including* papers whose acknowledgements contain the names of persons affiliated with the WPI program.)

B. WPI-related papers
Among papers published in 2012, list those related to the WPI program but whose authors are not noted in the institutional affiliations as WPI affiliated. (*Including* papers whose acknowledgements contain the names of researchers affiliated with the WPI program.)

Note: On 14 December 2011, the Basic Research Promotion Division in MEXT's Research Promotion Bureau circulated an instruction requiring paper authors to include the name or abbreviation of their WPI center among their institutional affiliations. As some WPI-affiliated authors of papers published up to 2013 may not be aware of this requirement, their papers are treated as "WPI-related papers." From 2014, however, the authors' affiliations must be clearly noted and only category A papers will be listed.

Newly selected centers are to list papers under category C below (in addition to categories A and B above).

C. Previously published important WPI-related papers
List previously published papers that provided the basis for the center's research project plan. (Around 30 papers as a yardstick.)

(2) Method of listing paper
- List only referred papers. Divide them into categories (e.g., original articles, reviews, proceedings).
- For each, write the author name(s); year of publication; journal name, volume, page(s), and article title. Any listing order may be used as long as format is the same. (The names of the center researchers do not need to be underlined.)
- If a paper has many authors (say, more than 20), all of their names do not need to be listed.
- If the papers are written in languages other than English, divide them into language categories when listing them.
- Assign a serial number to each paper to be used to identify it throughout the system.

(3) Submission of electronic data
- In addition to the above, for each paper provide a .cvs file output from the Web of Science (e.g.) or other database giving the paper's raw data including Document ID. (Note: the Document ID is assigned by paper database.)
- These files do not need to be divided into paper categories.

(4) Use in assessments
- The lists of papers will be used in assessing the state of WPI project's progress in FY 2012.
- They will be used as reference in analyzing the trends and states of research in all the WPI centers, not to evaluate individual researcher performance.
- The special characteristics of each research domain will be considered when conducting assessments.

(5) Additional documents
After all documents, including these paper listings, showing the state of research progress have been submitted, additional documents may be requested.

Order of Listing

A. WPI papers
1. Original articles
2. Review articles
3. Proceedings
4. Other English articles

5. Articles written in other than English

B. WPI-related papers
1. Original articles
2. Review articles
3. Proceedings
4. Other English articles
5. Articles written in other than English

C. Previously published WPI-related papers

A. WPI papers
1. Original articles

No.	Author names and details
5	REVISING THE HALOFIT MODEL FOR THE NONLINEAR MATTER POWER SPECTRUM Takahashi, Ryuichi; Sato, Masanori; Nishimichi, Takahiro; Taruya, Atsushi; Oguri, Masamune ASTROPHYSICAL JOURNAL 761(2), 152, DEC 20, 2012
12	Compact supersymmetry Murayama, Hitoshi; Nomura, Yasunori; Shirai, Satoshi; Tobioka, Kohsaku PHYSICAL REVIEW D 86(11), 115014, DEC 7, 2012
19	DEMOGRAPHICS AND PHYSICAL PROPERTIES OF GAS OUTFLOWS/INFLOWS AT 0.4 < z < 1.4 Martin, Crystal L.; Shapley, Alice E.; Coil, Alison L.; Kornei, Katherine A.; Bundy, Kevin; Weiner, Benjamin J.; Noeske, Kai G.; Schiminovich, David ASTROPHYSICAL JOURNAL 760(2), 127, DEC 1, 2012
23	THE NINTH DATA RELEASE OF THE SLOAN DIGITAL SKY SURVEY: FIRST SPECTROSCOPIC DATA FROM THE SDSS-III BARYON OSCILLATION SPECTROSCOPIC SURVEY Ahn, Christopher P., et al. ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES 203(2), 21, DEC, 2012
30	SYNMAG PHOTOMETRY: A FAST TOOL FOR CATALOG-LEVEL MATCHED COLORS OF EXTENDED SOURCES Bundy, Kevin; Hogg, David W.; Higgs, Tim D.; Nichol, Robert C.; Yasuda, Naoki; Masters, Karen L.; Lang, Dustin; Wake, David A. ASTRONOMICAL JOURNAL 144(6), 188, DEC, 2012
33	Confinement and Dynamical Symmetry Breaking in Non-SUSY Gauge Theory from S-Duality in String Theory Sugimoto, Shigeki PROGRESS OF THEORETICAL PHYSICS 128(6), pp. 1175-1209, DEC, 2012
35	Direct and fast calculation of regularized cosmological power spectrum at two-loop order Taruya, Atsushi; Bernardeau, Francis; Nishimichi, Takahiro; Codis, Sandrine PHYSICAL REVIEW D 86(10), 103528, NOV 26, 2012
47	Gluino decay as a probe of high scale supersymmetry breaking Sato, Ryosuke; Shirai, Satoshi; Tobioka, Kohsaku JOURNAL OF HIGH ENERGY PHYSICS (11), 41, NOV, 2012
52	Holographic renormalization of foliation preserving gravity and trace anomaly Nakayama, Yu GENERAL RELATIVITY AND GRAVITATION 44(11), pp. 2873-2889, NOV, 2012
54	Constraining sterile neutrinos with AMANDA and IceCube atmospheric neutrino data Esmaili, Arman; Halzen, Francis; Peres, O. L. G. JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS (11), 41, NOV, 2012
55	A weak lensing mass reconstruction of the large-scale filament feeding the massive galaxy cluster MACS J0717.5+3745 Jauzac, Mathilde; Jullo, Eric; Kneib, Jean-Paul; Ebeling, Harald; Leauthaud, Alexie; Ma, Cheng-Jiun; Limousin, Marceau; Massey, Richard; Richard, Johan MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 426(4), pp. 3369-3384, NOV, 2012

58	Miscentring in galaxy clusters: dark matter to brightest cluster galaxy offsets in 10 000 Sloan Digital Sky Survey clusters Zitrin, Adi; Bartelmann, Matthias; Umetsu, Keiichi; Oguri, Masamune; Broadhurst, Tom MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 426(4), pp. 2944-2956, NOV, 2012
66	Supersymmetry-breaking nonlinear sigma models Imai, Takumi; Izawa, K-I; Nakai, Yuichiro PHYSICS LETTERS B 717(41277), pp. 257-260, OCT 22, 2012
67	THE PROPERTIES AND PREVALENCE OF GALACTIC OUTFLOWS AT z similar to 1 IN THE EXTENDED GROTH STRIP Kornei, Katherine A.; Shapley, Alice E.; Martin, Crystal L.; Coil, Alison L.; Lotz, Jennifer M.; Schiminovich, David; Bundy, Kevin; Noeske, Kai G. ASTROPHYSICAL JOURNAL 758(2), 135, OCT 20, 2012
73	Using jet substructure at the LHC to search for the light Higgs bosons of the CP-violating MSSM Bhattacherjee, Biplob; Chakraborty, Amit; Ghosh, Dilip Kumar; Raychaudhuri, Sreerup PHYSICAL REVIEW D 86(7), 75012, OCT 9, 2012
75	Enhanced diphoton signal of the Higgs boson and the muon g-2 in gauge mediation models Sato, Ryosuke; Tobioka, Kohsaku; Yokozaki, Norimi PHYSICS LETTERS B 716(41338), pp. 441-445, OCT 2, 2012
79	Fusion products of Kirillov-Reshetikhin modules and the X = M conjecture Naoi, Katsuyuki ADVANCES IN MATHEMATICS 231(41337), pp. 1546-1571, OCT-NOV, 2012
98	GALAXIES IN X-RAY GROUPS. II. A WEAK LENSING STUDY OF HALO CENTERING George, Matthew R.; Leauthaud, Alexie; Bundy, Kevin; Finoguenov, Alexis; Ma, Chung-Pei; Rykoff, Eli S.; Tinker, Jeremy L.; Wechsler, Risa H.; Massey, Richard; Mei, Simona ASTROPHYSICAL JOURNAL 757(1), 2, SEP 20, 2012
106	INTRINSIC AMBIGUITY IN SECOND-ORDER VISCOSITY PARAMETERS IN RELATIVISTIC HYDRODYNAMICS Nakayama, Yu INTERNATIONAL JOURNAL OF MODERN PHYSICS A 27(22), 1250125, SEP 10, 2012
107	CAN THE GROWTH OF DUST GRAINS IN LOW-METALLICITY STAR-FORMING CLOUDS AFFECT THE FORMATION OF METAL-POOR LOW-MASS STARS? Nozawa, Takaya; Kozasa, Takashi; Nomoto, Ken'ichi ASTROPHYSICAL JOURNAL LETTERS 756(2), L35, SEP 10, 2012
126	A NEW MONTE CARLO METHOD FOR TIME-DEPENDENT NEUTRINO RADIATION TRANSPORT Abdikamalov, Ernazar; Burrows, Adam; Ott, Christian D.; Loeffler, Frank; O'Connor, Evan; Dolence, Joshua C.; Schnetter, Erik ASTROPHYSICAL JOURNAL 755(2), 111, AUG 20, 2012
132	THE CORRELATED FORMATION HISTORIES OF MASSIVE GALAXIES AND THEIR DARK MATTER HALOS Tinker, Jeremy L.; George, Matthew R.; Leauthaud, Alexie; Bundy, Kevin; Finoguenov, Alexis; Massey, Richard; Rhodes, Jason; Wechsler, Risa H. ASTROPHYSICAL JOURNAL LETTERS 755(1), L5, AUG 10, 2012
134	Limits on Majoron-emitting double-beta decays of Xe-136 in the KamLAND-Zen experiment Gando, A.; Gando, Y.; Hanakago, H.; Ikeda, H.; Inoue, K.; Kato, R.; Koga, M.; Matsuda, S.; Mitsui, T.; Nakada, T.; Nakamura, K.; Obata, A.; Oki, A.; Ono, Y.; Shimizu, I.; Shirai, J.; Suzuki, A.; Takemoto, Y.; Tamae, K.; Ueshima, K.; Watanabe, H.; Xu, B. D.; Yamada, S.; Yoshida, H.; Kozlov, A.; Yoshida, S.; Banks, T. I.; Detwiler, J. A.; Freedman, S. J.; Fujikawa, B. K.; Han, K.; O'Donnell, T.; Berger, B. E.; Efremenko, Y.; Karwowski, H. J.; Markoff, D. M.; Tornow, W.; Enomoto, S.; Decowski, M. P. PHYSICAL REVIEW C 86(2), 21601, AUG 6, 2012
146	Very small scale clustering of quasars from a complete quasar lens survey Kayo, Issha; Oguri, Masamune MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 424(2), pp. 1363-1371, AUG, 2012

154	Search for proton decay via p -> mu K-+(0) in Super-Kamiokande I, II, and III Regis, C., et al. PHYSICAL REVIEW D 86(1), 12006, JUL 23, 2012
172	THE FIRST MAXIMUM-LIGHT ULTRAVIOLET THROUGH NEAR-INFRARED SPECTRUM OF A TYPE Ia SUPERNOVA Foley, Ryan J.; Kromer, Markus; Marion, G. Howie; Pignata, Giuliano; Stritzinger, Maximilian D.; Taubenberger, Stefan; Challis, Peter; Filippenko, Alexei V.; Folatelli, Gaston; Hillebrandt, Wolfgang; Hsiao, Eric Y.; Kirshner, Robert P.; Li, Weidong; Morrell, Nidia I.; Roepke, Friedrich K.; Ciaraldi-Schoolmann, Franco; Seitenzahl, Ivo R.; Silverman, Jeffrey M.; Simcoe, Robert A.; Berta, Zachory K.; Ivarsen, Kevin M.; Newton, Elisabeth R.; Nysewander, Melissa C.; Reichart, Daniel E. ASTROPHYSICAL JOURNAL LETTERS 753(1), L5, JUL 1, 2012
189	Unified Description of Nambu-Goldstone Bosons without Lorentz Invariance Watanabe, Haruki; Murayama, Hitoshi PHYSICAL REVIEW LETTERS 108(25), 251602, JUN 21, 2012
194	Cosmic microwave background bispectrum from the lensing-Rees-Sciama correlation reexamined: Effects of nonlinear matter clustering Junk, Veronika; Komatsu, Eiichiro PHYSICAL REVIEW D 85(12), 123524, JUN 15, 2012
211	Production of dark matter axions from collapse of string-wall systems Hiramatsu, Takashi; Kawasaki, Masahiro; Saikawa, Ken'ichi; Sekiguchi, Toyokazu PHYSICAL REVIEW D 85(10), 105020, MAY 21, 2012
240	Instability in Magnetic Materials with a Dynamical Axion Field Ooguri, Hirosi; Oshikawa, Masaki PHYSICAL REVIEW LETTERS 108(16), 161803, APR 20, 2012
244	DISCOVERY OF SMALL-SCALE SPIRAL STRUCTURES IN THE DISK OF SAO 206462 (HD 135344B): IMPLICATIONS FOR THE PHYSICAL STATE OF THE DISK FROM SPIRAL DENSITY WAVE THEORY Muto, T., et al. ASTROPHYSICAL JOURNAL LETTERS 748(2), L22, APR 1, 2012
249	PRESUPERNOVA EVOLUTION AND EXPLOSIVE NUCLEOSYNTHESIS OF ZERO METAL MASSIVE STARS Limongi, M.; Chieffi, A. ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES 199(2), 38, APR, 2012

2. Review articles: NONE
3. Proceedings: NONE
4. Other English articles: NONE

B. WPI-related papers

1. Original articles

No.	Author names and details
1	High-Resolution Near-Infrared Polarimetry of a Circumstellar Disk around UX Tau A Tanii, Ryoko, et al. PUBLICATIONS OF THE ASTRONOMICAL SOCIETY OF JAPAN 64(6), 124, DEC 25, 2012
2	A Common Proper Motion Stellar Companion to HAT-P-7 Narita, Norio, et al. PUBLICATIONS OF THE ASTRONOMICAL SOCIETY OF JAPAN 64(6), L7, DEC 25, 2012
3	DARK ENERGY IN MODIFIED SUPERGRAVITY Ketov, Sergei V.; Watanabe, Natsuki MODERN PHYSICS LETTERS A 27(39), 1250225, DEC 21, 2012
4	MAGNITUDE GAP STATISTICS AND THE CONDITIONAL LUMINOSITY FUNCTION More, Surhud ASTROPHYSICAL JOURNAL 761(2), 127, DEC 20, 2012

6	BLACK HOLE MASS AND EDDINGTON RATIO DISTRIBUTION FUNCTIONS OF X-RAY-SELECTED BROAD-LINE AGNs AT z similar to 1.4 IN THE SUBARU XMM-NEWTON DEEP FIELD Nobuta, K., et al. ASTROPHYSICAL JOURNAL 761(2), 143, DEC 20, 2012
7	WEAKLY INTERACTING MASSIVE PARTICLE DARK MATTER AND FIRST STARS: SUPPRESSION OF FRAGMENTATION IN PRIMORDIAL STAR FORMATION Smith, Rowan J.; Iocco, Fabio; Glover, Simon C. O.; Schleicher, Dominik R. G.; Klessen, Ralf S.; Hirano, Shingo; Yoshida, Naoki ASTROPHYSICAL JOURNAL 761(2), 154, DEC 20, 2012
8	Strict Limit on CPT Violation from Polarization of gamma-Ray Bursts Toma, Kenji; Mukohyama, Shinji; Yonetoku, Daisuke; Murakami, Toshio; Gunji, Shuichi; Mihara, Tatehiro; Morihara, Yoshiyuki; Sakashita, Tomonori; Takahashi, Takuya; Wakashima, Yudai; Yonemochi, Hajime; Toukairin, Noriyuki PHYSICAL REVIEW LETTERS 109(24), 241104, DEC 13, 2012
9	IONIZATION SOURCE OF A MINOR-AXIS CLOUD IN THE OUTER HALO OF M82 Matsubayashi, K.; Sugai, H.; Shimono, A.; Hattori, T.; Ozaki, S.; Yoshikawa, T.; Taniguchi, Y.; Nagao, T.; Kajisawa, M.; Shioya, Y.; Bland-Hawthorn, J. ASTROPHYSICAL JOURNAL 761(1), 55, DEC 10, 2012
10	Consequences of a stochastic approach to the conformal invariance of inflationary correlators Motohashi, Hayato; Suyama, Teruaki; Yokoyama, Jun'ichi PHYSICAL REVIEW D 86(12), 123514, DEC 10, 2012
11	Gravitational wave signal from massive gravity Guemruekcueoglu, A. Emir; Kuroyanagi, Sachiko; Lin, Chunshan; Mukohyama, Shinji; Tanahashi, Norihiro CLASSICAL AND QUANTUM GRAVITY 29(23), 235026, DEC 7, 2012
13	Eluding the gravitino overproduction in inflaton decay Nakayama, Kazunori; Takahashi, Fuminobu; Yanagida, Tsutomu T. PHYSICS LETTERS B 718(2), pp. 526-531, DEC 5, 2012
14	Remarks on Hubble induced mass from fermion kinetic term Kawasaki, Masahiro; Takesako, Tomohiro PHYSICS LETTERS B 718(2), pp. 522-525, DEC 5, 2012
15	A supersymmetric SU(5) x T ' unified model of flavor with large theta(13) Meroni, Aurora; Petcov, S. T.; Spinrath, Martin PHYSICAL REVIEW D 86(11), 113003, DEC 3, 2012
16	PROTOSTELLAR FEEDBACK AND FINAL MASS OF THE SECOND-GENERATION PRIMORDIAL STARS Hosokawa, Takashi; Yoshida, Naoki; Omukai, Kazuyuki; Yorke, Harold W. ASTROPHYSICAL JOURNAL LETTERS 760(2), L37, DEC 1, 2012
17	SUBARU IMAGING OF ASYMMETRIC FEATURES IN A TRANSITIONAL DISK IN UPPER SCORPIUS Mayama, S., et al. ASTROPHYSICAL JOURNAL LETTERS 760(2), L26, DEC 1, 2012
18	THE DEPENDENCE OF QUENCHING UPON THE INNER STRUCTURE OF GALAXIES AT 0.5 <= z < 0.8 IN THE DEEP2/AEGIS SURVEY Cheung, Edmond, et al. ASTROPHYSICAL JOURNAL 760(2), 131, DEC 1, 2012
20	DISCOVERY AND EARLY MULTI-WAVELENGTH MEASUREMENTS OF THE ENERGETIC TYPE IC SUPERNOVA PTF12GZK: A MASSIVE-STAR EXPLOSION IN A DWARF HOST GALAXY Ben-Ami, Sagi, et al. ASTROPHYSICAL JOURNAL LETTERS 760(2), L33, DEC 1, 2012
21	THE STRUCTURE OF PRE-TRANSITIONAL PROTOPLANETARY DISKS. I. RADIATIVE TRANSFER MODELING OF THE DISK plus CAVITY IN THE PDS 70 SYSTEMDong, Ruobing, et al.ASTROPHYSICAL JOURNAL 760(2), 111, DEC 1, 2012
22	Fock model and Segal-Bargmann transform for minimal representations of Hermitian Lie groups Hilgert, Joachim; Kobayashi, Toshiyuki; Mollers, Jan; Orsted, Bent JOURNAL OF FUNCTIONAL ANALYSIS 263(11), pp. 3492-3563, DEC 1, 2012

24	The energy spectrum of Telescope Array's Middle Drum detector and the direct comparison to the High Resolution Fly's Eye experiment Abu-Zayyad, T., et al. ASTROPARTICLE PHYSICS 39-40, pp. 109-119, DEC, 2012
25	Accreting supermassive black holes in the COSMOS field and the connection to their host galaxies Bongiorno, A., et al. MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 427(4), pp. 3103-3133, DEC, 2012
26	EQUIVARIANT SEMI-TOPOLOGICAL INVARIANTS, ATIYAH'S KR-THEORY, AND REAL ALGEBRAIC CYCLES Heller, Jeremiah; Voineagu, Mircea TRANSACTIONS OF THE AMERICAN MATHEMATICAL SOCIETY 364(12), pp. 6565-6603, DEC, 2012
27	ON THE RATES OF TYPE Ia SUPERNOVAE IN DWARF AND GIANT HOSTS WITH ROTSE-IIIb Quimby, Robert M.; Yuan, Fang; Akerlof, Carl; Wheeler, J. Craig; Warren, Michael S. ASTRONOMICAL JOURNAL 144(6), 177, DEC, 2012
28	Submillimetre galaxies in cosmological hydrodynamic simulations: source number counts and the spatial clustering Shimizu, Ikkoh; Yoshida, Naoki; Okamoto, Takashi MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 427(4), pp. 2866-2875, DEC, 2012
29	Gravitational lensing in the Kerr-Randers optical geometry Werner, M. C. GENERAL RELATIVITY AND GRAVITATION 44(12), pp. 3047-3057, DEC, 2012
31	Numerical study of QCD phase diagram at high temperature and density by a histogram method Ejiri, Shinji; Aoki, Sinya; Hatsuda, Tetsuo; Kanaya, Kazuyuki; Nakagawa, Yoshiyuki; Ohno, Hiroshi; Saito, Hana; Umeda, Takashi CENTRAL EUROPEAN JOURNAL OF PHYSICS 10(6), pp. 1322-1325, DEC, 2012
32	The dominant role of mergers in the size evolution of massive early-type galaxies since z similar to 1 Lopez-Sanjuan, C., et al. ASTRONOMY & ASTROPHYSICS 548, A7, DEC, 2012
34	Constraints on hidden photon models from electron g-2 and hydrogen spectroscopy Endo, Motoi; Hamaguchi, Koichi; Mishima, Go PHYSICAL REVIEW D 86(9), 95029, NOV 27, 2012
36	PROSPECT OF STUDYING HARD X- AND GAMMA-RAYS FROM TYPE Ia SUPERNOVAE Maeda, K.; Terada, Y.; Kasen, D.; Roepke, F. K.; Bamba, A.; Diehl, R.; Nomoto, K.; Kromer, M.; Seitenzahl, I. R.; Yamaguchi, H.; Tamagawa, T.; Hillebrandt, W. ASTROPHYSICAL JOURNAL 760(1), 54, NOV 20, 2012
37	PROBING PRIMORDIAL NON-GAUSSIANITY WITH WEAK-LENSING MINKOWSKI FUNCTIONALS Shirasaki, Masato; Yoshida, Naoki; Hamana, Takashi; Nishimichi, Takahiro ASTROPHYSICAL JOURNAL 760(1), 45, NOV 20, 2012
38	UNUSUAL LONG AND LUMINOUS OPTICAL TRANSIENT IN THE SUBARU DEEP FIELD Urata, Yuji; Tsai, Patrick P.; Huang, Kuiyun; Morokuma, Tomoki; Yasuda, Naoki; Tanaka, Masaomi; Motohara, Kentaro; Hayashi, Masao; Kashikawa, Nobunari; Ly, Chun; Malkan, Matthew A. ASTROPHYSICAL JOURNAL LETTERS 760(1), L11, NOV 20, 2012
39	THE GLOBULAR CLUSTER SYSTEM OF NGC 4636 AND FORMATION OF GLOBULAR CLUSTERS IN GIANT ELLIPTICAL GALAXIES Park, Hong Soo; Lee, Myung Gyoon; Hwang, Ho Seong; Kim, Sang Chul; Arimoto, Nobuo; Yamada, Yoshihiko; Tamura, Naoyuki; Onodera, Masato ASTROPHYSICAL JOURNAL 759(2), 116, NOV 10, 2012
40	Solar system tests and interpretation of gauge field and Newtonian prepotential in general covariant Horava-Lifshitz gravity Lin, Kai; Mukohyama, Shinji; Wang, Anzhong PHYSICAL REVIEW D 86(10), 104024, NOV 7, 2012
41	Nonanomalous Discrete R Symmetry Decrees Three Generations Evans, Jason L.; Ibe, Masahiro; Kehayias, John; Yanagida, Tsutomu T. PHYSICAL REVIEW LETTERS 109(18), 181801, NOV 2, 2012
42	SPECTRAL ENERGY DISTRIBUTIONS OF TYPE 1 ACTIVE GALACTIC NUCLEI IN THE COSMOS SURVEY. I. THE XMM-COSMOS SAMPLEElvis, M., et al. ASTROPHYSICAL JOURNAL 759(1), 6, NOV 1, 2012

43	Shadows of multi-black holes: Analytic exploration Yumoto, Akifumi; Nitta, Daisuke; Chiba, Takeshi; Sugiyama, Naoshi PHYSICAL REVIEW D 86(10), 103001, NOV 1, 2012
44	A THEORETICAL COLOR-VELOCITY CORRELATION FOR SUPERNOVAE ASSOCIATED WITH GAMMA-RAY BURSTS Rapoport, Sharon; Sim, Stuart A.; Maeda, Keiichi; Tanaka, Masaomi; Kromer, Markus; Schmidt, Brian P.; Nomoto, Ken'ichi ASTROPHYSICAL JOURNAL 759(1), 38, NOV 1, 2012
45	SDSS 0956+5128: A BROAD-LINE QUASAR WITH EXTREME VELOCITY OFFSETS Steinhardt, Charles L.; Schramm, Malte; Silverman, John D.; Alexandroff, Rachael; Capak, Peter; Civano, Francesca; Elvis, Martin; Masters, Dan; Mobasher, Bahram; Pattarakijwanich, Petchara; Strauss, Michael A. ASTROPHYSICAL JOURNAL 759(1), 24, NOV 1, 2012
46	Peccei-Quinn extended gauge-mediation model with vector-like matter and 125 GeV Higgs Nakayama, Kazunori; Yokozaki, Norimi JOURNAL OF HIGH ENERGY PHYSICS (11), 158, NOV, 2012
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292	THE INTEGRATED STELLAR CONTENT OF DARK MATTER HALOS Leauthaud, Alexie; George, Matthew R.; Behroozi, Peter S.; Bundy, Kevin; Tinker, Jeremy; Wechsler, Risa H.; Conroy, Charlie; Finoguenov, Alexis; Tanaka, Masayuki ASTROPHYSICAL JOURNAL 746(1), 95, FEB 10, 2012
293	ORIGIN OF MULTIPLE NUCLEI IN ULTRALUMINOUS INFRARED GALAXIES Matsui, Hidenori; Saitoh, Takayuki R.; Makino, Junichiro; Wada, Keiichi; Tomisaka, Kohji; Kokubo, Eiichiro; Daisaka, Hiroshi; Okamoto, Takashi; Yoshida, Naoki ASTROPHYSICAL JOURNAL 746(1), 26, FEB 10, 2012
294	MATTER DISTRIBUTION AROUND GALAXIES Masaki, Shogo; Fukugita, Masataka; Yoshida, Naoki ASTROPHYSICAL JOURNAL 746(1), 0, FEB 10, 2012
295	Revisit to top quark forward-backward asymmetry Shu, Jing; Wang, Kai; Zhu, Guohuai PHYSICAL REVIEW D 85(3), 34008, FEB 7, 2012
296	Phase transition and monopole production in supergravity inflation Kamada, Kohei; Nakayama, Kazunori; Yokoyama, Jun'ichi PHYSICAL REVIEW D 85(4), 43503, FEB 3, 2012
297	EARLY-TYPE GALAXIES AT z similar to 1.3. IV. SCALING RELATIONS IN DIFFERENT ENVIRONMENTS Raichoor, A.; Mei, S.; Stanford, S. A.; Holden, B. P.; Nakata, F.; Rosati, P.; Shankar, F.; Tanaka, M.; Ford, H.; Huertas-Company, M.; Illingworth, G.; Kodama, T.; Postman, M.; Rettura, A.; Blakeslee, J. P.; Demarco, R.; Jee, M. J.; White, R. L. ASTROPHYSICAL JOURNAL 745(2), 130, FEB 1, 2012
298	Investigating generalized parton distribution in gravity dual Nishio, Ryoichi; Watari, Taizan PHYSICS LETTERS B 707(41337), pp. 362-368, FEB 1, 2012

299	SEARCH FOR EXTRATERRESTRIAL ANTINEUTRINO SOURCES WITH THE KamLAND DETECTOR Gando, A., et al. ASTROPHYSICAL JOURNAL 745(2), 193, FEB 1, 2012
300	Deep 1.1 mm-wavelength imaging of the GOODS-S field by AzTEC/ASTE - II. Redshift distribution and nature of the submillimetre galaxy population Yun, Min S., et al. MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 420(2), pp. 957-985, FEB, 2012
301	Halo abundances and counts-in-cells: the excursion set approach with correlated steps Paranjape, Aseem; Lam, Tsz Yan; Sheth, Ravi K. MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 420(2), pp. 1429-1441, FEB, 2012
302	The Standardizability of Type Ia Supernovae in the Near-Infrared: Evidence for a Peak-Luminosity Versus Decline-Rate Relation in the Near-Infrared Kattner, ShiAnne; Leonard, Douglas C.; Burns, Christopher R.; Phillips, M. M.; Folatelli, Gaston; Morrell, Nidia; Stritzinger, Maximilian D.; Hamuy, Mario; Freedman, Wendy L.; Persson, Sven E.; Roth, Miguel; Suntzeff, Nicholas B. PUBLICATIONS OF THE ASTRONOMICAL SOCIETY OF THE PACIFIC 124(912), pp. 114-127, FEB, 2012
303	Signatures of supersymmetry with non-universal Higgs mass at the Large Hadron Collider Bhattacharya, Subhaditya; Biswas, Sanjoy; Mukhopadhyaya, Biswarup; Nojiri, Mihoko M. JOURNAL OF HIGH ENERGY PHYSICS (2), 104, FEB, 2012
304	Using galaxy-galaxy weak lensing measurements to correct the finger of God Hikage, Chiaki; Takada, Masahiro; Spergel, David N. MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 419(4), pp. 3457-3481, FEB, 2012
305	Non-standard s-process in low metallicity massive rotating stars Frischknecht, U.; Hirschi, R.; Thielemann, F. -K. ASTRONOMY & ASTROPHYSICS 538, L2, FEB, 2012
306	Isocurvature perturbations in extra radiation Kawasaki, Masahiro; Miyamoto, Koichi; Nakayama, Kazunori; Sekiguchi, Toyokazu JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS (2), 22, FEB, 2012
307	A hierarchy of voids: more ado about nothing Paranjape, Aseem; Lam, Tsz Yan; Sheth, Ravi K. MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 420(2), pp. 1648-1655, FEB, 2012
308	Soliton stars as holographic confined Fermi liquids Bhattacharya, Jyotirmoy; Ogawa, Noriaki; Takayanagi, Tadashi; Ugajin, Tomonori JOURNAL OF HIGH ENERGY PHYSICS (2), 137, FEB, 2012
309	SYZ MIRROR SYMMETRY FOR TORIC CALABI-YAU MANIFOLDS Chan, Kwokwai; Lau, Siu-Cheong; Leung, Naichung Conan JOURNAL OF DIFFERENTIAL GEOMETRY 90(2), pp. 177-250, FEB, 2012
310	The galaxy stellar mass function of X-ray detected groups Environmental dependence of galaxy evolution in the COSMOS survey Giodini, S.; Finoguenov, A.; Pierini, D.; Zamorani, G.; Ilbert, O.; Lilly, S.; Peng, Y.; Scoville, N.; Tanaka, M. ASTRONOMY & ASTROPHYSICS 538, A104, FEB, 2012
311	Ionized bubble number count as a probe of non-Gaussianity Tashiro, Hiroyuki; Sugiyama, Naoshi MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 420(1), pp. 441-446, FEB, 2012
312	Cross-correlating the thermal Sunyaev-Zel'dovich effect and the distribution of galaxy clusters Fang, Wenjuan; Kadota, Kenji; Takada, Masahiro PHYSICAL REVIEW D 85(2), 23007, JAN 23, 2012
313	AVERAGE METALLICITY AND STAR FORMATION RATE OF Ly alpha EMITTERS PROBED BY A TRIPLE NARROWBAND SURVEY Nakajima, Kimihiko; Ouchi, Masami; Shimasaku, Kazuhiro; Ono, Yoshiaki; Lee, Janice C.; Foucaud, Sebastien; Ly, Chun; Dale, Daniel A.; Salim, Samir; Finn, Rose; Almaini, Omar; Okamura, Sadanori ASTROPHYSICAL JOURNAL 745(1), 12, JAN 20, 2012

314	UNBURNED MATERIAL IN THE EJECTA OF TYPE Ia SUPERNOVAE Folatelli, Gaston; Phillips, M. M.; Morrell, Nidia; Tanaka, Masaomi; Maeda, Keiichi; Nomoto, Ken'ichi; Stritzinger, Maximilian; Burns, Christopher R.; Hamuy, Mario; Mazzali, Paolo; Boldt, Luis; Campillay, Abdo; Contreras, Carlos; Gonzalez, Sergio; Roth, Miguel; Salgado, Francisco; Freedman, W. L.; Madore, Barry F.; Persson, S. E.; Suntzeff, Nicholas B. ASTROPHYSICAL JOURNAL 745(1), 74, JAN 20, 2012
315	BARYON CONTENT OF MASSIVE GALAXY CLUSTERS AT z=0-0.6 Lin, Yen-Ting; Stanford, S. Adam; Eisenhardt, Peter R. M.; Vikhlinin, Alexey; Maughan, Ben J.; Kravtsov, Andrey ASTROPHYSICAL JOURNAL LETTERS 745(1), L3, JAN 20, 2012
316	A gamma-ray signature of energetic sources of cosmic-ray nuclei Kusenko, Alexander; Voloshin, M. B. PHYSICS LETTERS B 707(2), pp. 255-258, JAN 20, 2012
317	Cosmological axino problem Cheung, Clifford; Elor, Gilly; Hall, Lawrence J. PHYSICAL REVIEW D 85(1), 15008, JAN 18, 2012
318	Higgs mass and inflation Nakayama, Kazunori; Takahashi, Fuminobu PHYSICS LETTERS B 707(1), pp. 142-145, JAN 16, 2012
319	SPECTROSCOPIC CONFIRMATION OF THREE z-DROPOUT GALAXIES AT z=6.844-7.213: DEMOGRAPHICS OF Ly alpha EMISSION IN z similar to 7 GALAXIES Ono, Yoshiaki; Ouchi, Masami; Mobasher, Bahram; Dickinson, Mark; Penner, Kyle; Shimasaku, Kazuhiro; Weiner, Benjamin J.; Kartaltepe, Jeyhan S.; Nakajima, Kimihiko; Nayyeri, Hooshang; Stern, Daniel; Kashikawa, Nobunari; Spinrad, Hyron ASTROPHYSICAL JOURNAL 744(2), 83, JAN 10, 2012
320	NEW CONSTRAINTS ON THE EVOLUTION OF THE STELLAR-TO-DARK MATTER CONNECTION: A COMBINED ANALYSIS OF GALAXY-GALAXY LENSING, CLUSTERING, AND STELLAR MASS FUNCTIONS FROM z=0.2 to z=1 Leauthaud, Alexie, et al. ASTROPHYSICAL JOURNAL 744(2), 159, JAN 10, 2012
321	A DETECTION OF WEAK-LENSING MAGNIFICATION USING GALAXY SIZES AND MAGNITUDES Schmidt, Fabian; Leauthaud, Alexie; Massey, Richard; Rhodes, Jason; George, Matthew R.; Koekemoer, Anton M.; Finoguenov, Alexis; Tanaka, Masayuki ASTROPHYSICAL JOURNAL LETTERS 744(2), L22, JAN 10, 2012
322	INTERNAL STRUCTURE OF PROTOCLUSTER GALAXIES: ACCELERATED STRUCTURAL EVOLUTION IN OVERDENSE ENVIRONMENTS? Zirm, Andrew W.; Toft, Sune; Tanaka, Masayuki ASTROPHYSICAL JOURNAL 744(2), 181, JAN 10, 2012
323	Bayesian analysis of the astrobiological implications of life's early emergence on Earth Spergel, David S.; Turner, Edwin L. PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA 109(2), pp. 395-400, JAN 10, 2012
324	Parity violation in QCD process Haba, Naoyuki; Kaneta, Kunio; Matsumoto, Shigeki; Nabeshima, Takehiro; Tsuno, Soshi PHYSICAL REVIEW D 85(1), 14007, JAN 10, 2012
325	Identifying the origin of longevity of meta-stable stau at the LHC Ito, Takumi; Nakaji, Kouhei; Shirai, Satoshi PHYSICS LETTERS B 706(41369), pp. 314-319, JAN 5, 2012
326	A SINGLE DEGENERATE PROGENITOR MODEL FOR TYPE Ia SUPERNOVAE HIGHLY EXCEEDING THE CHANDRASEKHAR MASS LIMIT Hachisu, Izumi; Kato, Mariko; Saio, Hideyuki; Nomoto, Ken'ichi ASTROPHYSICAL JOURNAL 744(1), 69, JAN 1, 2012
327	CORRELATIONS IN THE (SUB) MILLIMETER BACKGROUND FROM ACT x BLAST Hajian, Amir, et al. ASTROPHYSICAL JOURNAL 744(1), 40, JAN 1, 2012

328	Radon removal from gaseous xenon with activated charcoal Abe, K., et al. NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH SECTION A-ACCELERATORS SPECTROMETERS DETECTORS AND ASSOCIATED EQUIPMENT 661(1), pp. 50-57, JAN 1, 2012
329	QCD-scale modified-gravity universe Klinkhamer, F. R. ADVANCES IN SPACE RESEARCH 49(1), pp. 213-221, JAN 1, 2012
330	Grids of stellar models with rotation I. Models from 0.8 to 120 M-circle dot at solar metallicity (Z=0.014) Ekstroem, S.; Georgy, C.; Eggenberger, P.; Meynet, G.; Mowlavi, N.; Wyttenbach, A.; Granada, A.; Decressin, T.; Hirschi, R.; Frischknecht, U.; Charbonnel, C.; Maeder, A. ASTRONOMY & ASTROPHYSICS 537, A146, JAN, 2012
331	Holographic Fermi surfaces and entanglement entropy Ogawa, Noriaki; Takayanagi, Tadashi; Ugajin, Tomonori JOURNAL OF HIGH ENERGY PHYSICS (1), 125, JAN, 2012
332	Matter and singularities Morrison, David R.; Taylor, Washington JOURNAL OF HIGH ENERGY PHYSICS (1), 22, JAN, 2012
333	String theory of the Omega deformation Hellerman, Simeon; Orlando, Domenico; Reffert, Susanne JOURNAL OF HIGH ENERGY PHYSICS (1), 148, JAN, 2012
334	Full-sky lensing reconstruction of gradient and curl modes from CMB maps Namikawa, Toshiya; Yamauchi, Daisuke; Taruya, Atsushi JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS (1), 7, JAN, 2012
335	The Type II supernovae 2006V and 2006au: two SN 1987A-like events Taddia, F.; Stritzinger, M. D.; Sollerman, J.; Phillips, M. M.; Anderson, J. P.; Ergon, M.; Folatelli, G.; Fransson, C.; Freedman, W.; Hamuy, M.; Morrell, N.; Pastorello, A.; Persson, S. E.; Gonzalez, S. ASTRONOMY & ASTROPHYSICS 537, A140, JAN, 2012
336	New lensed quasars from the MUSCLES survey Jackson, Neal; Rampadarath, Hayden; Ofek, Eran O.; Oguri, Masamune; Shin, Min-Su MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 419(3), pp. 2014-2024, JAN, 2012
337	Boltzmann equation for non-equilibrium particles and its application to non-thermal dark matter production Hamaguchi, Koichi; Moroi, Takeo; Mukaida, Kyohei JOURNAL OF HIGH ENERGY PHYSICS (1), 83, JAN, 2012
338	Signals of the cosmological reionization in the radio sky through C and O fine structure lines Kusakabe, M.; Kawasaki, M. MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 419(1), pp. 873-894, JAN, 2012
339	Stability conditions and curve counting invariants on Calabi-Yau 3-folds Toda, Yukinobu KYOTO JOURNAL OF MATHEMATICS 52(1), pp. 1-50, SPR, 2012
340	On eigenfunctions corresponding to a small resurgent eigenvalue Getmanenko, Alexander ASYMPTOTIC ANALYSIS 76(2), pp. 87-114, , 2012
341	Anomalies and the Euler characteristic of elliptic Calabi-Yau threefolds Grassi, Antonella; Morrison, David R. COMMUNICATIONS IN NUMBER THEORY AND PHYSICS 6(1), pp. 51-127, , 2012
342	REMARKS ON FILTRATIONS OF THE HOMOLOGY OF REAL VARIETIES Heller, Jeremiah; Voineagu, Mircea DOCUMENTA MATHEMATICA 17, pp. 641-661, , 2012
344	The Origin of Matter - Leptogenesis Yanagida, Tsutomu T. PROGRESS OF THEORETICAL PHYSICS SUPPLEMENT (197), pp. 46-47, , 2012

96* Affiliations of only the first and second authors are explicitly shown in the article. For the other authors, their affiliations are referred to the collaboration web-site (www.grips-mission.eu).

2. Review articles

No.	Author names and details
133	Entanglement entropy from a holographic viewpoint Takayanagi, Tadashi CLASSICAL AND QUANTUM GRAVITY 29(15), 153001, AUG 7, 2012
140	Review of new physics effects in t(t)over-bar production Kamenik, Jernej F.; Shu, Jing; Zupan, Jure EUROPEAN PHYSICAL JOURNAL C 72(8), 2102, AUG, 2012
179	The universal Einstein radius distribution from 10 000 SDSS clusters Zitrin, Adi; Broadhurst, Tom; Bartelmann, Matthias; Rephaeli, Yoel; Oguri, Masamune; Benitez, Narciso; Hao, Jiangang; Umetsu, Keiichi MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 423(3), pp. 2308-2324, JUL, 2012
255	Hadron interactions from lattice QCD Hatsuda, T. PROGRESS IN PARTICLE AND NUCLEAR PHYSICS 67(2), pp. 122-129, APR, 2012
269	Combined strong and weak lensing analysis of 28 clusters from the Sloan Giant Arcs Survey Oguri, Masamune; Bayliss, Matthew B.; Dahle, Hakon; Sharon, Keren; Gladders, Michael D.; Natarajan, Priyamvada; Hennawi, Joseph F.; Koester, Benjamin P. MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 420(4), pp. 3213-3239, MAR, 2012
271	PTF10iya: a short-lived, luminous flare from the nuclear region of a star-forming galaxy Cenko, S. Bradley, et al. MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 420(3), pp. 2684-2699, MAR, 2012
272	Dust in historical Galactic Type Ia supernova remnants with Herschel Gomez, H. L.; Clark, C. J. R.; Nozawa, T.; Krause, O.; Gomez, E. L.; Matsuura, M.; Barlow, M. J.; Besel, M. -A.; Dunne, L.; Gear, W. K.; Hargrave, P.; Henning, Th.; Ivison, R. J.; Sibthorpe, B.; Swinyard, B. M.; Wesson, R. MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 420(4), pp. 3557-3573, MAR, 2012
343	Atmospheric Neutrinos Kajita, Takaaki ADVANCES IN HIGH ENERGY PHYSICS, 504715, , 2012

3. Proceedings

No.	Author names and details
345* (see note)	Homological representations of braid groups and KZ connections Kohno, Toshitake Journal of Singularities 5, pp. 94-108, 2012
346* (see note)	Hyperplane arrangements, local system homology and iterated integrals Kohno, Toshitake Arrangements of hyperplanes : Sapporo 2009 (Advanced studies in pure mathematics ; 62), pp. 157-174, 2012
347* (see note)	Quantum and homological representations of braid groups Kohno, Toshitake Configuration spaces : geometry, combinatorics and topology (CRM series ; 14), pp. 355-372, 2012

345*, 346*, 347*: These are refereed papers, but the journals in which they appear are not covered by Web of Science.

4. Other English articles: NONE
5. Articles written in other than English: NONE

B. Invited Lectures, Plenary Addresses (etc.) at International Conferences and International Research Meetings

- List up to 10 main presentations during FY2012 in order from most recent.
- For each, write the lecturer/presenter's name, presentation title, conference name and date(s)

No.	Lecturer/presenter names and details
1	Toshiyuki Kobayashi Branching Laws for Infinite Dimensional Representations of Real Reductive Lie Groups Mathematical Panorama Lectures in celebration of 125th birthday of Srinivasa Ramanujan 2013 February 18-22, Tata Institute, India
2	Shigeki Sugimoto Holographic QCD -Status and perspectives for the future- Xth Quark Confinement and the Hadron Spectrum 2012 October 8-12, TUM, Garching, Germany
3	Hitoshi Murayama Physics at the Frontiers SUSY 2012 (20th International Conference On Supersymmetry And Unification Of Fundamental Interactions) 2012 August 13-17, Beijing, China
4	Ken'ichi Nomoto Nucleosynthesis in Hypernovae and Other Unusual Supernovae, compared with the Abundance Patterns of Extremely Metal-Poor Stars XII International Symposium on Nuclei in the Cosmos 2012 August 5-12, Cairns, Australia
5	Hirosi Ooguri, Conference Summary STRINGS 2012 Conference 2012 July 23-28, Ludwig-Maximilians-Universität München
6	Tomoyuki Abe Langlands program for p-adic coefficients and petits camarades conjecture Pan Asian Number Theory Conference 2012 July 17-27, IISER Pune, India
7	Taizan Watari A Note on Kahler Potential of Charged Matter in F- theory CERN Theory Inst 2012 on String Phenomenology 2012 July 9-20, CERN, Geneva
8	Shinji Mukohyama Modified Gravity The Thirteenth Marcel Grossmann Meeting 2012 July 1-7 , Stockholm U, Stockholm
9	John Silverman Tracing the distribution of star-forming galaxies at z~1.5 in COSMOS with Subaru/FMOS IAP-Subaru Joint Conference: Stellar Populations Across Cosmic Time 2012 June 25-29, IAP, Paris
10	Todor Milanov Orbifold projective lines and integrable hierarchies Workshop on Singularity theory and integrable systems 2012 April 22-28, Oberwolfach, Germany

C. Major Awards
- List up to 10 main awards received during FY2012 in order from the most recent.
- For each, write the recipient's name, name of award, and year issued.
- In case of multiple recipients, underline those affiliated with the center.

No.	Recipient names and details
1	Kunio Inoue and Atsuto Suzuki Yoji Totsuka Memorial Prize March 2013
2	Masayuki Tanaka Astronomical Society of Japan's Young Astronomer Award March 2013
3	Nobuhiro Okabe, Masahiro Takada, Keiichi Umetsu, Toshifumi Futamase, Graham P. Smith PASJ (Publications of the Astronomical Society of Japan) Excellent Paper Award February 2013
4	Eiichiro Komatsu Lancelot M. Berkeley - New York Community Trust Prize for Meritorious Work in Astronomy January 2013
5	Hirosi Ooguri Fellow of the American Mathematical Society January 2013
6	Kunio Inoue Nishina Memorial Prize December 2012
7	Yukinobu Toda Geometry Prize (Mathematical Society of Japan) August 2012
8	Twenty six members of the WMAP (Wilkinson Microwave Anisotropy Probe) team including David Spergel and Eiichiro Komatsu Gruber Cosmology Prize August 2012
9	Hirosi Ooguri Simons Investigator Award July 2012

FY 2012 List of Principal Investigators

NOTE:
・Underline names of investigators who belong to an overseas research institution. Place an asterisk (*) by names of investigators considered to be ranked among world's top researchers.
・In case of researchers not listed in the latest report, attach "Biographical Sketch of a New Principal Investigator".

<Results at the end of FY2012>

Principal Investigators Total: 18

Name (Age)	Affiliation (Position title, department, organization)	Academic degree, specialty	Working hours (Total working hours: 100%)				Starting date of project participation	Status of project participation (Describe in concrete terms)	Contributions by PIs from overseas research institutions
			Work on center project		Others				
			Research activities	Other activities	Research activities	Other activities			
Center director Hitoshi Murayama (49) (*)	Kavli IPMU (Director), University of California, Berkeley (Professor, Physics Dept)	Ph.D. particle theory, cosmology	45%	40%	0%	15%	10/1/2007	Stays 70% at Kavli IPMU, and 30% at UC Berkeley of which a half of the time at Kavli IPMU Berkeley satellite. Joins videoconference 4 times a week.	Sending 2 young scientists (2 weeks each) and 2 senior scientists (1 week each). Accepting 5 young scientists (2 weeks each).
Yoichiro Suzuki (63) (*)	Kavli IPMU (Deputy Director), University of Tokyo (Professor, ICRR)	Ph.D. astroparticle physics	70%	5%	5%	20%	10/1/2007	Usually stays at Kamioka Branch. Joins videoconference once a week	
Hiroaki Aihara (57)(*)	Kavli IPMU (Deputy Director), University of Tokyo (Professor, Physics Dept)	Ph.D. High energy physics	45%	5%	0%	50%	10/1/2007	Stays at Kavli IPMU once a month. Joins videoconference once a week.	
Alexey Bondal (51) (*)	Steklov Mathematical Institute (Professor) Kavli IPMU (Professor, joint appointment)	Ph.D. mathematics	40%	0%	40%	20%	10/1/2007	Stays at Kavli IPMU 6 months a year. Joins videoconference once a week for the rest of 6 months.	Sending 1 senior scientist (2 weeks).

Kunio Inoue (47) (*)	Tohoku University (Professor, RCNS)	Ph.D. astropatrticle physics	45%	0%	5%	50%	10/1/2007	Stays at Kamioka Branch once a week.	
Takaaki Kajita (54) (*)	University of Tokyo (Director, Professor, ICRR)	Ph.D. astropatrticle physics	40%	0%	0%	60%	10/1/2007	Stays at Kamioka Branch once a month. Usually stays at ICRR which is right next to Kavli IPMU.	
Stavros Katsanevas (59) (*)	University of Paris 7 (Professor, Physics Dept)	Ph.D. astropatrticle physics	20%	0%	10%	70%	10/1/2007	Stays at Kavli IPMU once a year. Joins videoconference once a month.	Sending 1 young scientist to Kavli IPMU (3 weeks).
Toshiyuki Kobayashi (50) (*)	University of Tokyo (Professor, School of Mathematical Sciences)	Ph.D. mathematics	70%	0%	8%	22%	6/1/2011	Stays at Kavli IPMU once a month. Joins videoconference once a month.	
Toshitake Kohno (57) (*)	University of Tokyo (Professor, School of Mathematical Sciences)	Ph.D. mathematics	70%	0%	8%	22%	10/1/2007	Stays at Kavli IPMU once a week. Joins videoconference once a week.	
Masayuki Nakahata (53) (*)	University of Tokyo (Professor, ICRR)	Ph.D. astropatrticle physics	85%	0%	9%	6%	10/1/2007	Usually stays at Kamioka Branch.	
Mihoko Nojiri (50) (*)	KEK (Professor)	Ph.D. particle theory	40%	0%	40%	20%	10/1/2007	Stays at Kavli IPMU twice a week.	

Ken'ichi Nomoto (66) (*)	Kavli IPMU (Professor)	Ph.D. cosmology	70%	0%	12%	18%	10/1/2007	Stays at Kavli IPMU full time.	
Hirosi Ooguri (51) (*)	California Institute of Technology (Professor, Physics Dept and Mathematics Dept) Kavli IPMU (Professor, joint appointment)	Ph.D. string theory	66%	0%	3%	31%	10/1/2007	Stays at Kavli IPMU 3 months a year. Joins videoconference once a week for the rest of 9 months.	Sending 1 young scientist (2 weeks). Accepting 2 young scientists (2 weeks each).
Kyoji Saito (68) (*)	Kavli IPMU (Professor)	Ph.D. mathematics	80%	20%	0%	0%	10/1/2007	Stays at Kavli IPMU full time.	
David Spergel (52) (*)	Princeton University (Professor, Astronomical Sciences Dept)	Ph.D. cosmology	55%	0%	5%	40%	10/1/2007	Stays at Kavli IPMU once a year. Joins videoconference once a week.	Sending 1 professor (1 month), 4 young scientists (2 weeks each).
Henry Sobel (69) (*)	University of California Irvine (Professor, Physics Dept)	Ph.D. astroparticle physics	50%	0%	13%	37%	10/1/2007	Stays at Kamioka Branch 4 times a year. Joins videoconference once a week.	Sending 7 young scientists t (3 weeks each).
Naoshi Sugiyama (51) (*)	Nagoya University (Professor, Physics Dept)	Ph.D. cosmology	47%	0%	3%	50%	10/1/2007	Stays at Kavli IPMU once a month. Joins videoconference once a week.	
Tsutomu Yanagida (64) (*)	Kavli IPMU (Professor)	Ph.D. particle theory	90%	0%	0%	10%	10/1/2007	Stays at Kavli IPMU full time.	

Researchers unable to participate in project in FY 2012

Name	Affiliation (Position title, department, organization)	Starting date of project participation	Reasons	Measures taken

Records of FY2012 Center Activities

1. Researchers and center staffs, satellites, partner institutions

1-1. Number of researchers in the "core" established within the host institution

- Enter the total number of people in the columns below. In the "Researchers" column, put the number and percentage of overseas researchers in the < > brackets and the number and percentage of female researchers in the [ ] brackets.
- In the "Administrative staffs" column, put the number and percentage of bilingual staffs in the ( ) brackets.
- In the "Final Goal" column, enter the currently projected goal and the estimated date for achieving it [OO month, OO year].

	Goal set in the "Post-interim evaluation revised center project"	Results at end of FY 2012	Final goal (Date: 4, 2016)
Researchers	213 <83, 39%> [5, 2%]	236 < 105, 44%> [12, 5%]	213 <83, 39%> [5, 2%]
Principal investigators	22 <8, 36%> [1, 5%]	18 <4, 22%> [1, 6%]	22 <8, 36%> [1, 5%]
Other researchers	191 <75, 39%> [4, 2%]	218 <101, 46%> [11, 5%]	191 <75, 39%> [4, 2%]
Research support staffs	28	27	28
Administrative staffs	10	10 (3, 30%)	10 (3, 30%)
Total	251	273	251

Other matters of special mention

- Enter matters warranting special mention, such as concrete plans for achieving the Center's goals, established schedules for employing main researchers, particularly principal investigators.

We have been trying to hire a new foreign mathematician as a PI, using a President's discretionary position. However, systemic issues concerning salary levels on such a position as well as employment beyond the age of 65 are hampering our effort. We just started a discussion on an alternative possibility using joint appointments with Faculty of Mathematical Sciences.

- As background to how the Center is working to mobilize/circulate the world's best brains, give good examples, if any, of how career paths are being established for the Center's researchers; that is, from which top-world research institutions do researchers come to the Center and to which research institutions do the Center's researchers go, and how long are their stays at those institutions.

Our policy for mobilizing and circulating the world's best brains is to recruit the brightest young people as post-doctoral researchers and provide them with the best research environment so that they can make outstanding accomplishments during their 3-year term at Kavli IPMU and become strong candidates for either faculty positions or other post-doctoral positions at prestigious research institutions.

By the end of FY 2013 we had hired 86 postdocs and 47 had left Kavli IPMU, some before expiration of the 3-year term. We have been able to recruit postdocs from a wide variety of research institutions in the world and many of them have been recruited from top-level research institutions such as Harvard, Princeton, MIT, and Chicago in US, University College London, Amsterdam, Ludwig-Maximilians, and ETH in Europe, and top-level research institutions in other regions such as Seoul National U, U of Chile, U of

Sao Paulo, and TIFR. Out of the 47 postdocs left Kavli IPMU, 20 found faculty positions (McGill, Arizona State, Iowa State, Chonnam National, Zhejian, Hong Kong, Yokohama National, Kobe, Kyushu, Tohoku, Kyoto, Tsukuba, NAOJ, and others), and 22 took another appointment as postdoc at prestigious institutions such as CERN and Max-Planck Institute.

1-2. Satellites and partner institutions

- List the satellite and partner institutions in the table below.
- Indicate newly added and deleted institutions in the "Notes" column.
- If satellite institutions have been established, describe by satellite the Center's achievements in coauthored papers and researcher exchanges in Appendix 4.

<Satellite institutions>

Institution name	Principal Investigator(s), if any	Notes
University of California Berkeley	Hitoshi Murayama	

< Partner institutions>

Institution name	Principal Investigator(s), if any	Notes
Institut des Hautes Études Scientifiques (IHES)		
Kyoto University, Yukawa Institute for Theoretical Physics		
Kyoto University, Department of Physics		
High Energy Accelerator Research Organization (KEK)	Mihoko Nojiri	
National Astronomical Observatory in Japan (NAOJ)		
Princeton University, Department of Astrophysical Sciences	David Spergel	
Tohoku University, Research Center for Neutrino Sciences	Kunio Inoue	

2. Securing competitive research funding

- Competitive and other research funding secured in FY2012:

Total: 1225M yen

- Describe external funding warranting special mention. Include the name and total amount of each grant.

671M yen for SuMIRe Project (Subaru Measurement of Images and Redshifts) funded by the FIRST Program (Funding Program for World-Leading Innovative R&D on Science and Technology.

29.9M yen for JSPS's Institutional Program for Young Researcher Overseas Visits (starting from March 1, 2010).

3. International research conferences or symposiums held to bring world's leading researchers together

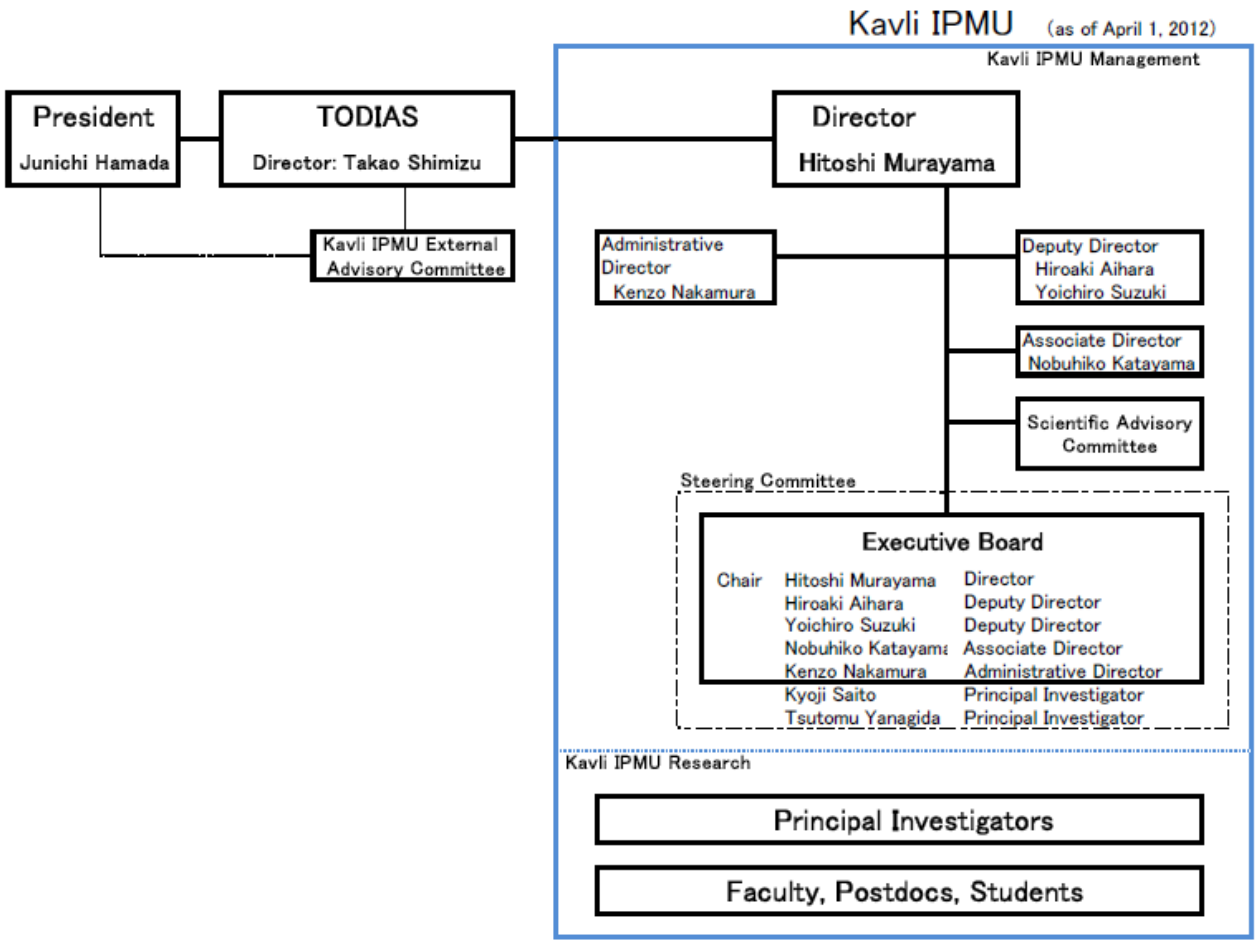
- Indicate the number of international research conferences or symposiums held in FY2012 and give up to three examples of the most representative ones using the table below.

FY 2012: 11 meetings

Major examples (meeting title and place held)	Number of participants
Workshop "Geometry and Physics of the Landau Ginzburg Model" Kavli IPMU	From domestic institutions: 37 From overseas institutions: 21
Open Meeting for Hyper-Kamiokande Project Kavli IPMU	From domestic institutions: 56 From overseas institutions: 39
Workshop "Homological Projective Duality and Quantum Gauge Theory" Kavli IPMU	From domestic institutions: 21 From overseas institutions: 25

4. Center's management system

- Please diagram management system in an easily understood manner.

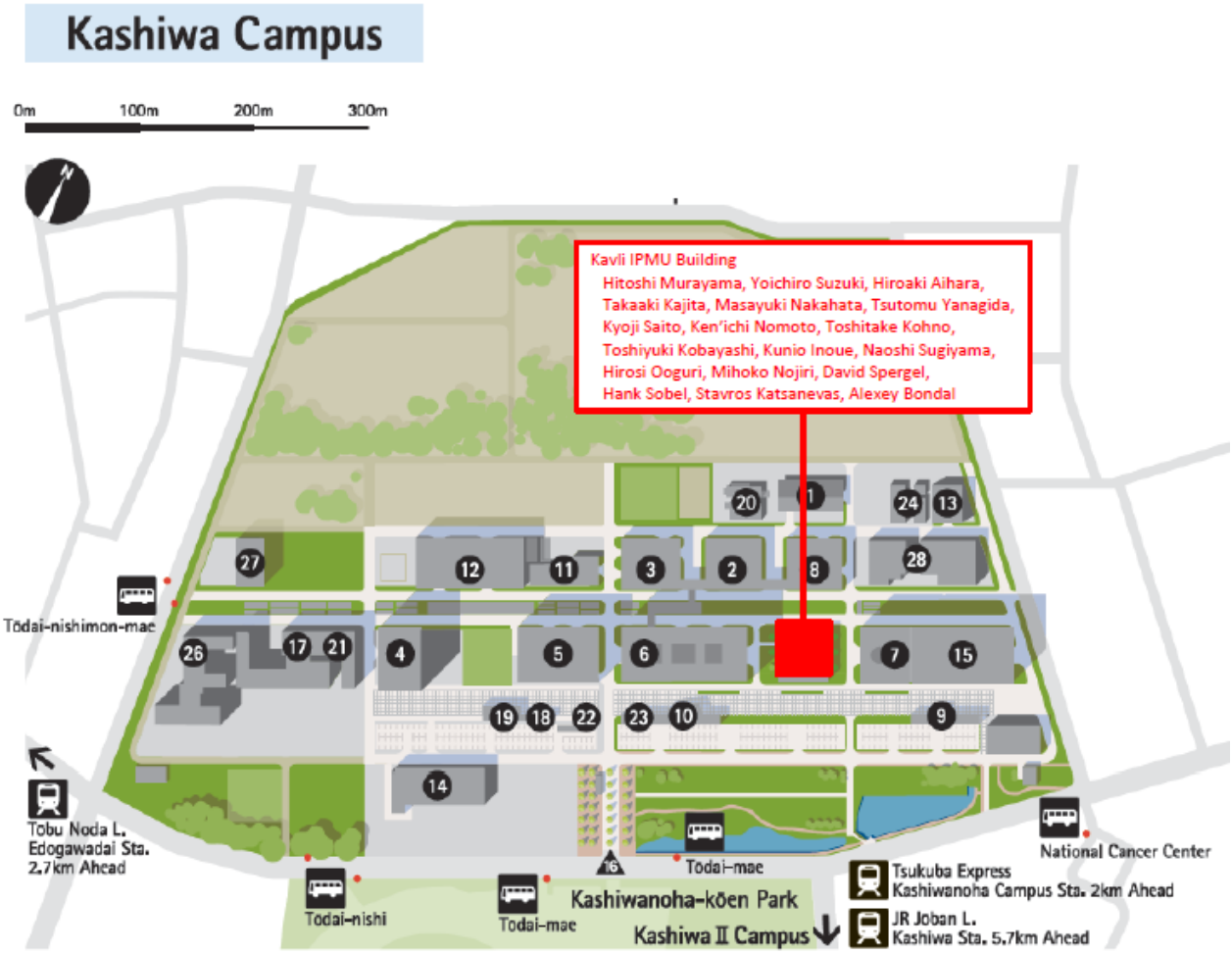


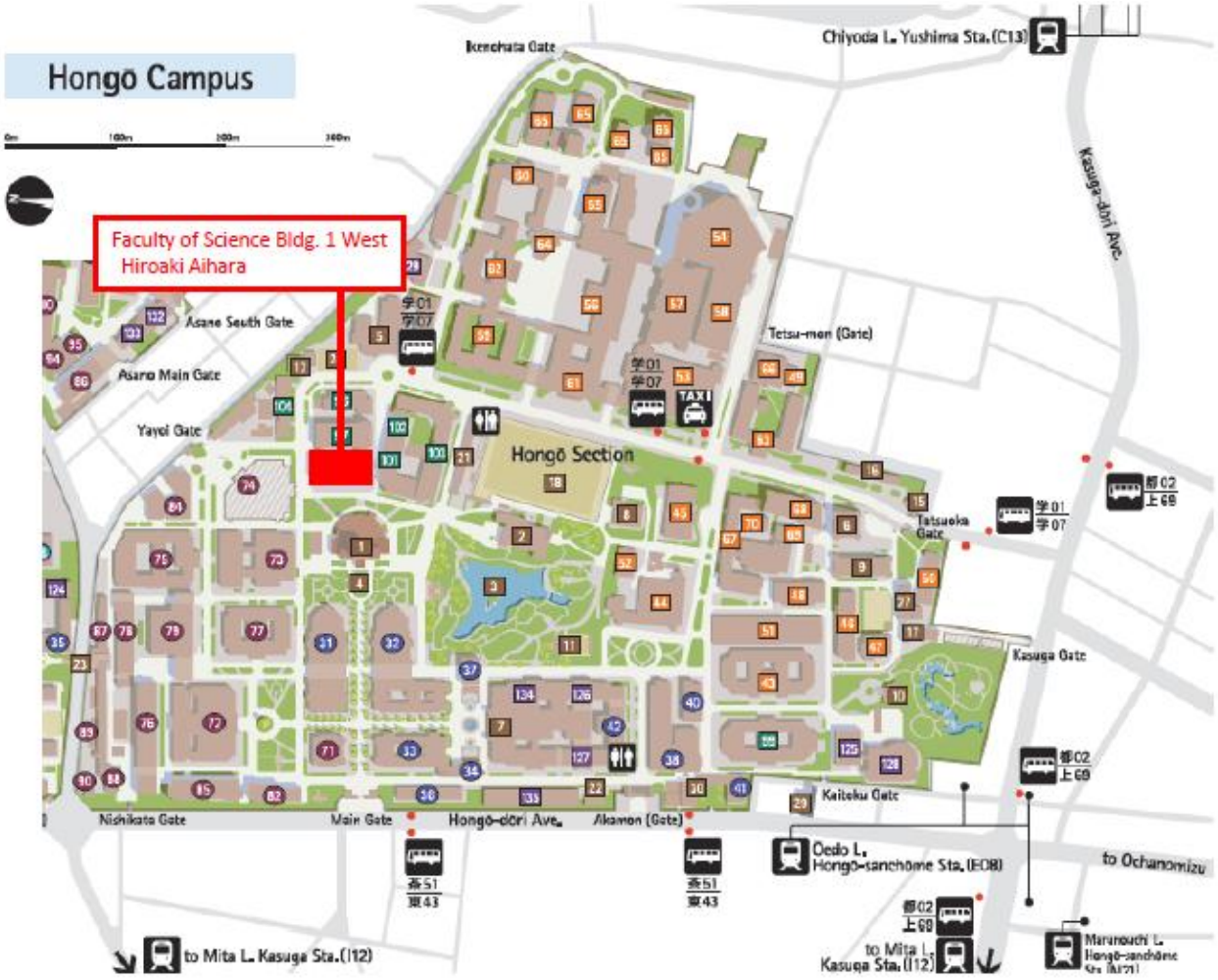
- If any changes have been made in the management system from that in the"Post-interim evaluation revised center project," please describe them. Please describe any changes made in the administrative director, head of host institution, and officer(s) in charge at the host institution (e.g., executive vice president for research)

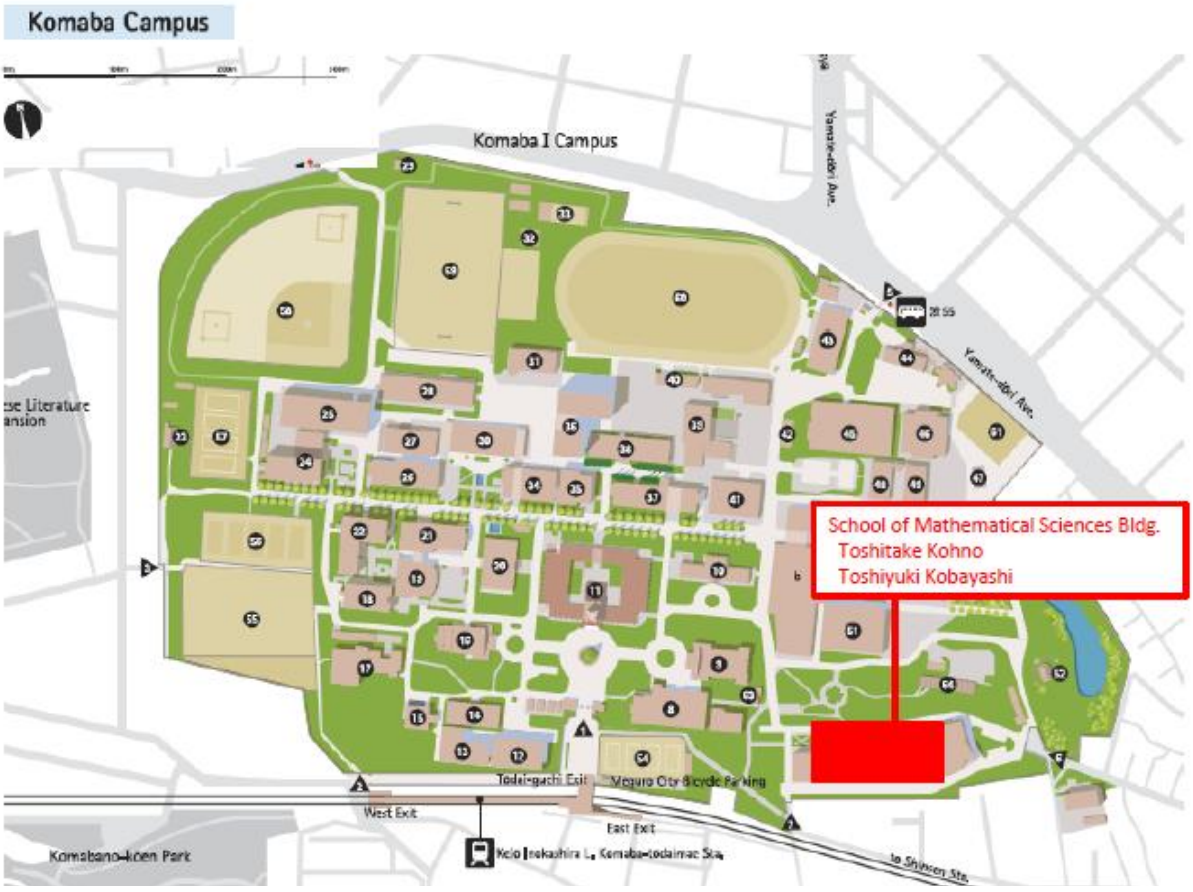
Starting with April 1, 2012, Nobuhiko Katayama joined Kavli IPMU as an Associate Director. His function is to handle Kavli IPMU's every-day on-site management on behalf of Director Murayama when he is outside Kashiwa campus. Associate Director Katayama also joined the Executive Board as well as the Steering Committee as a member. Also starting with April 1, 2012, Professor Takao Shimizu took over TODIAS Director from Professor Sadanori Okamura.

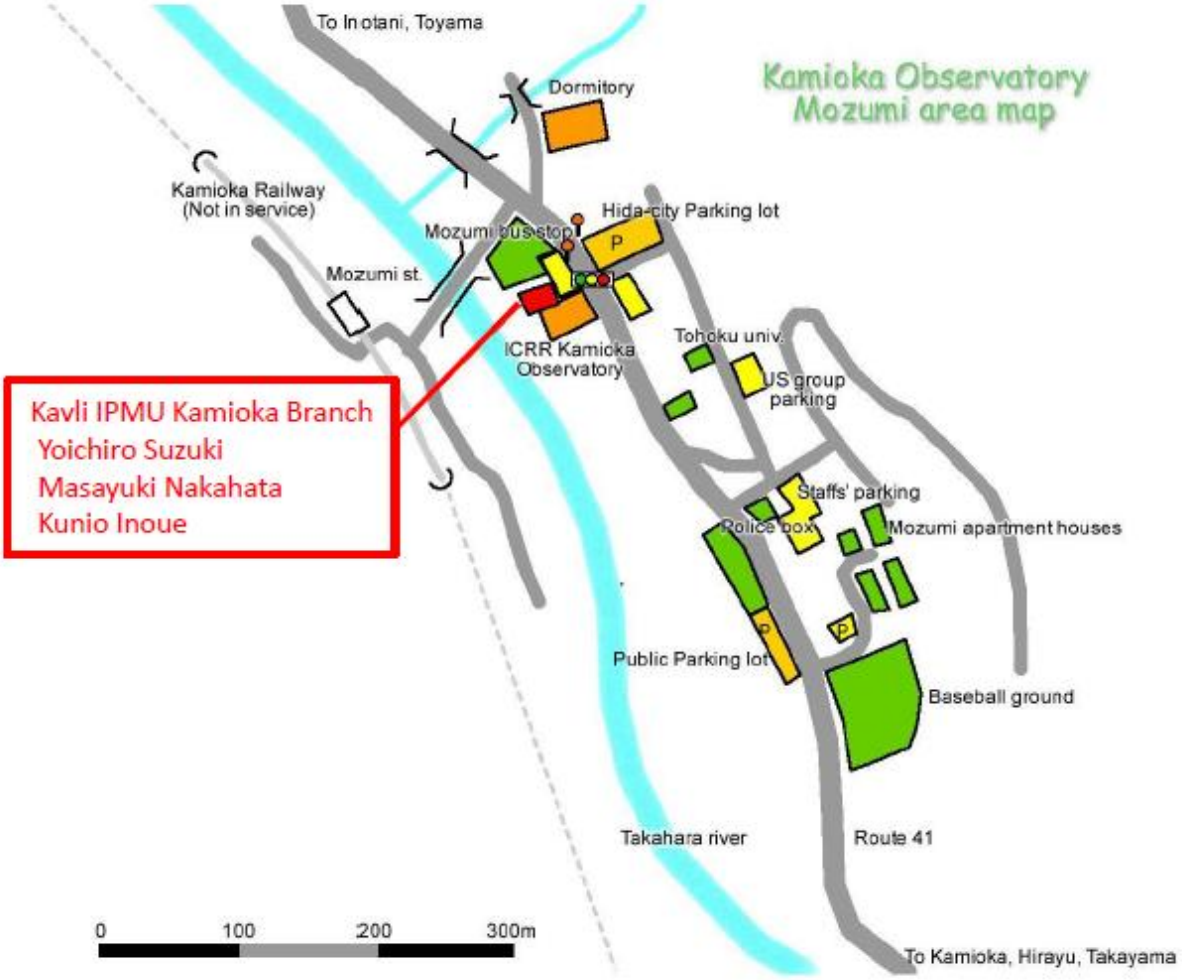
5. Campus Map

- Please draw a simple map of the campus showing where the main office and principle investigator(s) are located.




Hongo Campus
Faculty of Science Bldg. 1 West
Hiroaki Aihara
Ikenohata Gate
Chiyoda L. Yushima Sta. (C13)
Kasuga-dori Ave.
Asano South Gate
Asano Main Gate
Yayoi Gate
Tetsu-mon (Gate)
Hongo Section
Tatsuoka Gate
Kasuga Gate
Nishikata Gate
Main Gate
Hongo-dori Ave.
Akamon (Gate)
Kaiteku Gate
Oedo L. Hongo-sanchome Sta. (E08)
to Ochanomizu
to Mita L. Kasuga Sta. (I12)
Marunouchi L. Hongo-sanchome Sta. (M21)


Komaba Campus
Komaba I Campus
Yamate-dori Ave.
School of Mathematical Sciences Bldg.
Toshitake Kohno
Toshiyuki Kobayashi
West Exit
East Exit
Komaba-Todaimae Sta.
to Shibuya Sta.


Kamioka Observatory
Mozumi area map
To Inotani, Toyama
Dormitory
Kamioka Railway
(Not in service)
Mozumi bus stop
Hida-city Parking lot
P
Mozumi st.
ICRR Kamioka
Observatory
Tohoku univ.
US group
parking
Staffs' parking
Police box
Mozumi apartment houses
P
P
Public Parking lot
Baseball ground
Takahara river
Route 41
0
100
200
300m
To Kamioka, Hirayu, Takayama
Kavli IPMU Kamioka Branch
Yoichiro Suzuki
Masayuki Nakahata
Kunio Inoue

6. FY2012 Project Expenditures (the exchange rate used: 1USD= 80JPY)

i) Overall project funding

Cost Items	Details	Costs (10,000 dollars)
Personnel	Center director and Administrative director	41
	Principal investigators (no. of persons):9	111
	Other researchers (no. of persons):119	924
	Research support staffs (no. of persons):25	115
	Administrative staffs (no. of persons):9	93
	Total	1284
Project activities	Gratuities and honoraria paid to invited principal investigators (no. of persons):21	35
	Cost of dispatching scientists (no. of persons):1	1
	Research startup cost (no. of persons):54	34
	Cost of satellite organizations (no. of satellite organizations):1	4
	Cost of international symposiums (no. of symposiums):11	1
	Rental fees for facilities	279
	Cost of consumables	141
	Cost of utilities	32
	Other costs	80
	Total	607
Travel	Domestic travel costs	12
	Overseas travel costs	45
	Travel and accommodations cost for invited scientists (no. of domestic scientists):51 (no. of overseas scientists):243	53
	Travel cost for scientists on secondment (no. of domestic scientists):1 (no. of overseas scientists):20	10
	Total	120
Equipment	Depreciation of buildings	115
	Depreciation of equipment	558
	Total	673
Other research projects	Projects supported by other government subsidies, etc.	508
	Commissioned research projects, etc.	0
	Grants-in-Aid for Scientific Research, etc.	1024
	Total	1532
Total		4216

Ten thousand dollars

WPI grant			1698
Costs of establishing and maintaining facilities			5
Establishing new facilities (Number of facilities: , m²)		Costs paid:	
Repairing facilities (Number of facilities: , m²)		Costs paid:	
Others			5
Cost of equipment procured			14
Name of equipment: clean room expansion Number of units:	1	Costs paid:	6
Name of equipment: data logger Number of units:	2	Costs paid:	1
Others			6

ii) Costs of Satellites and Partner institutions

Cost Items	Details	Costs (10,000 dollars)
Personnel	Principal investigators (no. of persons):0	3
	Other researchers (no. of persons):1	
	Research support staffs (no. of persons):0	
	Administrative staffs (no. of persons):0	
	Total	3
Project activities		0
Travel		1
Equipment		0
Other research projects		0
Total		4

Status of Collaboration with Overseas Satellites

1. Coauthored Papers

- List the refereed papers published in FY2012 that were coauthored between the center's researcher(s) in domestic institution(s) and overseas satellite institution(s). List them by overseas satellite institution in the below blocks.
- Transcribe data in same format as in Appendix 1. Italicize the names of authors affiliated with overseas satellite institutions.
- For reference write the Appendix 1 item number in parentheses after the item number in the blocks below.

Overseas Satellite 1 (Total: 2 papers)

No.	Author names and details
1-12	Compact supersymmetry Murayama, Hitoshi; *Nomura, Yasunori*; Shirai, Satoshi; Tobioka, Kohsaku PHYSICAL REVIEW D 86(11), 115014, DEC 7, 2012
1-302	Limits on Majoron-emitting double-beta decays of Xe-136 in the KamLAND-Zen experiment Gando, A.; Gando, Y.; Hanakago, H.; Ikeda, H.; Inoue, K.; Kato, R.; Koga, M.; Matsuda, S.; Mitsui, T.; Nakada, T.; Nakamura, K.; Obata, A.; Oki, A.; Ono, Y.; Shimizu, I.; Shirai, J.; Suzuki, A.; Takemoto, Y.; Tamae, K.; Ueshima, K.; Watanabe, H.; Xu, B. D.; Yamada, S.; Yoshida, H.; Kozlov, A.; Yoshida, S.; Banks, T. I.; Detwiler, J. A.; *Freedman, S. J.; Fujikawa, B. K.*; Han, K.; O'Donnell, T.; Berger, B. E.; Efremenko, Y.; Karwowski, H. J.; Markoff, D. M.; Tornow, W.; Enomoto, S.; Decowski, M. P. PHYSICAL REVIEW C 86(2), 21601, AUG 6, 2012

Overseas Satellite 2 (Total: OO papers)

No.	Author names and details
2-	
2-	
2-	

2. Status of Researcher Exchanges

- Using the below tables, indicate the number and length of researcher exchanges in FY2012. Enter by institution and length of exchange.
- Write the number of principal investigator visits in the top of each space and the number of other researchers in the bottom.

Overseas Satellite 1:

<To satellite>

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2012	0 0	0 0	0 2	0 0	0 2

<From satellite>

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2012	0 1	0 3	0 0	0 0	0 4

Overseas Satellite 2:

<To satellite>

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2012					

<From satellite>

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2012					

FY 2012 Visit Records of World Top-caliber Researchers from Abroad

Researchers Total: 26

Name (Age)	Current affiliation (Position title, department, organization)	Academic degree, specialty	Record of research activities (Awards record, etc.)	Time, duration	Summary of activities during stay at center (e.g., participation as principal investigator; short-term stay for joint research; participation in symposium)
Roger Blandford (63)	Director, KIPAC, SLAC & Stanford U.	Ph.D. Cosmology	Warner Prize for Astronomy (1982) Heineman Prize for Astrophysics (1998) Eddington Medal (1999) Humboldt Prize (2011)	2012/5/8 -2012/5/11	Participation in Symposium
Sergei Blinnikov (63)	Head Scientist, Laboratory for Astrophysics and Plasma Physics, ITEP	Ph.D. Astronomy	Two signs (medals) for excellence from Atomic Energy Ministry in Russia	2013/2/2 -2013/2/13	Short-term stay for joint research
Judy Cohen (66)	Kate Van Nuys Page Professor of Astronomy, Caltech	Ph.D. Astronomy	Fullam Award of the Dudley Observatory (2001)	2013/3/24/ -2013/3/29	Participation in Symposium
George Efstathiou (57)	Director, Kavli Institute of Cosmology at U. of Cambridge	Ph.D. Astronomy	Maxwell Medal and Prize (1990) Fellow of the Royal Society (since 1994) Bodossaki Foundation Academic and Cultural Prize for Astrophysics (1994) Heineman Prize for Astrophysics (2005) Gruber Prize in Cosmology (2011)	2012/5/8 -2012/5/11	Participation in Symposium
John Ellis (66)	Clerk Maxwell Professor of Theoretical Physics, King's College London	Ph.D. Particle Theory	Maxwell Medal and Prize (1982) Paul Dirac Medal and Prize (2005) Fellow of the Royal Society of London (since 1985) Fellow of the Institute of Physics (since 1991) Commander of the Order of the British Empire (2012)	2012/7/23 -2012/7/25	Participation in External Advisory Committee

Richard Ellis (63)	Steele Professor of Astronomy, Caltech	Ph.D. Astronomy	Fellow of the Royal Society (since 1995) Fellow of the Institute of Physics (since 1998) Fellow of AAAS (since 2001) Gruber Prize in Cosmology (2007) Commander of the Order of the British Empire (2008) Gold Medal, Royal Astronomical Society (2011)	2013/3/24 -2013/3/27	Participation in Symposium
Harald Fritzsch (70)	Professor Emeritus, Ludwig-Maximilians Universität München	Ph.D. Particle Theory	Dirac Medal and Lecture (2008)	2012/5/14 -2012/6/9	Short-term stay for joint research
James Gunn (74)	Eugene Higgins Professor of Astronomy, Princeton U.	Ph.D. Astrophysics	Heineman Prize (1988) Gold Medal of the Royal Astronomical Society (1994) Crafoord Prize (2005) Gruber Cosmology Prize (2005) National Medal of Science (2009)	2013/3/23 -2013/3/29	Participation in Symposium
Steven Kahn (57)	Cassius Lamb Kirk Professor in the Natural Sciences, Stanford U. & SLAC	Ph.D. Cosmology	Fellow of the American Physical Society (since 1991) Member of AAAS (since 2012)	2012/7/23 -2012/7/25	Participation in External Advisory Committee
Edward Kearns (53)	Professor, Boston U.	Ph.D. Neutrino Physics	Rossi Prize (1989) Asahi Prize (1999) Fellow of the American Physical Society (since 2007)	2012/8/21 -2012/8/23 2013/1/14 -2013/1/18	Short-term stay for joint research and participation in symposium
Eiichiro Komatsu (37)	Director, Max-Planck Institute for Astrophysics	Ph.D. Cosmology	Nishinomiya-Yukawa Memorial Prize (2010) Gruber Cosmology Prize (2012) Lancelot Berkeley Prize (2013)	2012/6/1 -2012/7/31	Short-term stay for joint research as a Kavli IPMU scientific associate and lecturer in a summer science school
Alexander Kusenko (46)	Professor, UCLA	Ph.D. Particle Theory	Fellow of the American Physical Society (since 2008) American Physical Society Outstanding Referee Award (2012)	2012/10/12 -2012/12/13	Short-term stay for joint research as a Kavli IPMU scientific associate

Ernest Ma (66)	Professor, UC Riverside	Ph.D. Particle Theory	Fellow of the American Physical Society (since 1996)	2012/4/2 -2012/4/29	Short-term stay for joint research
David R. Morrison (57)	Professor, UC Santa Barbara	Ph.D. Mathematics	Fellow of the American Mathematical Society (2013)	2012/7/19 -2012/7/25	Participation in External Advisory Committee, Giving seminar talks
Keith Olive (55)	Distinguished McKnight University Professor of Physics U. of Minnesota	Ph.D. Cosmology	George Taylor Research Award (1988) Fellow of the American Physical Society (since 2003)	2013/1/20 -2012/1/26	Giving a talk at Kavli IPMU seminar and short-term stay for joint research
Roberto Peccei (71)	Professor, UCLA	Ph.D. Particle Theory	Fellow of the American Physical Society (since 1987) Fellow of the Institute of Physics Fellow of AAAS (since 2006) Fellow of the World Academy of Arts and Sciences (since 2008) J.J. Sakurai Prize for Theoretical Particle Physics (2013)	2012/7/22 -2012/7/25	Participation in External Advisory Committee
Serguey Petcov (61)	Professor, SISSA	Ph.D. Particle Theory	Bruno Pontecorvo Prize (2010)	2012/4/24 -2012/6/2 2012/11/2 -2012/11/24 2013/2/26 -2013/3/8 2013/3/19 -2013/3/31	Short-term stay for joint research as a Kavli IPMU scientific associate
Brian Schmidt (46)	Distinguished Professor, Australian National U.	Ph.D. Astronomy	Nobel Prize in Physics (2011) Australian Government's Malcolm McIntosh Prize (2000) Bok Prize (2000) Australian Academy of Science's Pawsey Medal (2001) Shaw Prize in Astronomy (2006) Gruber Cosmology Prize (2007) Companion of the Order of Australia (2013)	2012/11/19 -2012/11/21	Giving a public lecture & a seminar talk

George Smoot (68)	Professor, UC Berkeley & LBNL	Ph.D. Astrophysics	Nobel Prize in Physics (2006) Albert Einstein Medal (2003) Oersted Medal (2009)	2013/3/24 -2013/3/25	Participation in Symposium
Henry Sobel (69)	Professor, UC Irvine	Ph.D. Astroparticle Physics	Rossi Prize (1989) Asahi Prize (1999) Pontecorvo Prize (2009) Fellow of the American Physical Society (since 1998) Fellow of AAAS (since 2008)	2012/4/16 -2012/4/20 2012/8/21 -2012/8/25 2013/1/14 -2013/1/15	Short-term stay for joint research Participation in Symposium
James Stone (64)	Professor, Boston U.	Ph.D. High Energy Physics	Rossi Prize (1989) Asahi Prize (1999) Jefferson Science Fellow (2009)	2012/5/15 -2012/5/24 2012/8/21 -2012/8/23 2013/1/14 -2013/1/15	Short-term stay for joint research Participation in Symposium
Michael Strauss (51)	Professor, Princeton U.	Ph.D. Astronomy	Newton Lacy Pierce Prize (American Astronomical Society) (1996)	2013/3/23 -2013/3/27	Short-term stay for joint research Participation in Symposium
Robert Svoboda (56)	Professor, UC Davis	Ph.D. Neutrino Physics	Rossi Prize (1989) Asahi Prize (1999)	2012/8/21 -2012/8/23 2013/1/14 -2013/1/15	Participation in Symposium
Henry Tye (65)	Horace White Professor of Physics, Cornell U.	Ph.D. Particle Theory	Fellow of the American Physical Society (since 2007)	2012/10/2 -2012/10/4	Giving a talk at Kavli IPMU seminar and short-term stay for joint research
David Wark (54)	Professor, Imperial College London	Ph.D. Neutrino Physics	Fellow of the Royal Society (since 2007) Le Prix La Recherche (Physics Prize) (2012)	2012/8/21 -2012/8/23 2013/1/14 -2013/1/15	Participation in Symposium
Yue-Liang Wu (50)	Director, KITPC (Kavli Institute for Theoretical Physics China)	Ph.D. Astrophysics	The state award of Natural Science Prize (China) (2005)	2012/5/8 -2012/5/11	Participation in Symposium

State of Outreach Activities

- Using the table below, show the achievements of the Center's outreach activities in FY2012 (number of activities, times held).
- Describe those activities that have yielded novel results or that warrant special mention in the "Special Achievements" space below.
- In appendix 7, list and describe media coverage (e.g., articles published, programs aired) in FY2012 resulting from press releases and reporting.

Activities	FY2012(number of activities, times held)
PR brochure, pamphlet	7
Lectures, seminars for general public	13
Teaching, experiments, training for elementary and secondary school students	7
Science cafe	3
Open houses	1
Participating, exhibiting in events	3
Press releases	33

Special Achievements

Creation of a new content by academic-industrial cooperation

- Cooperation with "Sony ExplorerScience", Sony Corporation's Science Museum, to create a 3D movie "Story of Beginning of the Universe."
  *Kavli IPMU supervised the movie's story and 3D images to reflect the recent research results from Astronomy, Astrophysics, and Cosmology.
  The movie is shown in the regular exhibition at the museum since 2012 July, and Kavli IPMU utilizes it in outreach events.

WPI Joint outreach events

- WPI Joint Symposium in Tsukuba (2012 Nov 24)
  *From Kavli IPMU, a foreign researcher gave a talk and attracted the audience which comprised mostly high-school students.

- Science & Technology Festa (Kagakugijutsu Festa) 2013 in Kyoto (2013 Mar 16-17)
  *Attracted people with interactive programs, including talk sessions, and a 3D movie program.

- AAAS Annual Meeting in Boston, USA. (2013 Feb 14-18)
  *Contributed toward appealing WPI's presence to over 1,100 visitors from across the states and world at the WPI booth in AAAS Annual Meeting, as the organizer of the WPI booth.

Live Webcast of Public lecture

- Live webcast of a public lecture
  *Provided chance for a broader audience to watch Kavli IPMU's outreach activity online. Director Murayama talked to high school students and general public on "Challenge for the mystery of the universe" via Ustream Live. Over 800 viewers watched a live webcasted public lecture.

Social Networking Services (SNS) for general public

Blog

- Kavli IPMU semi-official blog: http://ipmu.exblog.jp (Press Officer: 2008 Jul-)
- Hirosi Ooguri: http://planck.exblog.jp/ (Professor Ooguri : 2009 Jan-)

Facebook
- Hitoshi Murayama-Kavli IPMU (Director Murayama : 2013.Feb-)
  https://www.facebook.com/pages/Hitoshi-Murayama-Kavli-IPMU/289807884480621

Twitter
- Twitter（account: IPMUlife）http://twitter.com/#!/IPMUlife (2011.May -)

Books for general readers

Books, written by Kavli IPMU's researcher became best sellers and often found in book reviews of major newspapers, magazines as well as TV programs.

＜New in FY 2012＞
- The Landscape of Particle Physics Hirosi Ooguri (2012 Apr/ Sugaku Shobo Publishing)

- What is Gravity?" Hirosi Ooguri (2012 May / Gentosha Publishing)
  *Sold over 150,000 copies

- "Why do we exist in the universe?" Hitoshi Murayama (2013 Jan / Kodansha Blue-Backs)
  *Sold 70,000 copies

- "Strong force and Weak force ~ dissolve the magic of Higgs boson~" Hirosi Ooguri
  (2013 Jan. Gentosha Publishing)
  *Sold 15,000 copies

<Perennial best sellers>

- "One and the only one universe?" Hitoshi Murayama (2011 Jul / Kodansha Blue-Backs)
  *Sold 100,000 copies

- "Miracle of beautiful universe" Hitoshi Murayama (2012 Jan/ Shueisha International)
  *Sold 25,000 copies

- "What is the universe made of?" Hitoshi Murayama (2010 Sep/ Gentosha Publishing)
  *Sold 310,000 copies

FY 2012 List of Project's Media Coverage

- Select main items of coverage, and list them within these 2 pages.

No.	Date	Type media (e.g., newspaper, television)	Description
1	2012/4/5	The Yomiuri Shimbun	Exploration – Particle physics theory challenges the mystery of Dark Matter *Interviewing with Director Murayama
2	2012/4/16 2012/4/11	The Nikkei Shimbun Jiji press (Web)	<Press Release: 2012/04/10> "Cosmic Mirages" confirm accelerated cosmic expansion (Dr. Masamune Ooguri)
3	2012/5/10	The Yomiuri Shimbun	Cutting Edge - 70% of Dark Matter found in intergalactic space *Interviewing with Director Murayama and Dr.Yoshida
4	2012/5/10	The Mainichi Shimbun/ The Asahi Shimbun/ The Sankei Shimbun/ The Nikkei Shimbun/ The Yomiuri Shimbun	Director Murayama and Mr. Fred Kavli (Founder of The Kavli Foundation) visited Japanese Prime Minister, Yoshihiko Noda.
5	2012/5/4&11 2012/5/18 issues	Weekly Asahi (magazine)	Cosmology update *Interviewing with Director Murayama, Dr. Takada, Dr. Matsumoto and other researchers at Kavli IPMU.
6	2012/5/17	The Nikkei Shimbun/ The Nikkei Digital	Create the new frontier -Addressing mysteries of the universe by integrating knowledge of physics and mathematics *Introducing Kavli IPMU and Director Murayama
7	2012/June issue	Nikkei Science	Front Runner – Superstring theory challenges the mysteries of the universe * Interviewing with Dr. Hirosi Ooguri
8	2012/6/9	NHK News/ The Yomiuri Shimbun/ The Asahi Shimbun/ The Sankei Shimbun/ The Mainichi Shimbun	<Press Release: 2012/06/08> Theorem unifies superfluid and other weird material (Director Murayama)
9	2012/July issue	Highlighting Japan	Nurturing global talent *Introducing Kavli IPMU and Director Murayama
10	2012/7/4	Newline (NHK WORLD)	CERN's finding marks new stage in space exploration *Interviewing with Dr. Matsumoto
11	2012/7/5	The Mainichi Shimbun/ The Asahi Shimbun/ The Sankei Shimbun/ The Nikkei Shimbun/ The Yomiuri Shimbun	<Press Lecture：2012/07/04> Murayama talks about the discovery of Higgs boson-like particle

12	2012/7/7	Ohayo Nippon (NHK)	Kavli IPMU's Science Cafe at Tamarokuto Planetarium in the traditional Tanabata (July 7th) evening *Interviewing with Dr. Yoshida, a speaker at the event
13	2012/7/19	Close Up Gendai (NHK)	"Discovery of a century - Higgs Boson -" *Director Murayama appears a program as a guest speaker.
14	2012/8/3	The Nikkei Shimbun/ The Sankei Shimbun/ The Yomiuri Shimbun/ Kagaku Shimbun and others	<Press Release: 2012/08/03> Clumpy Structure of Supernova Explosions -- A Subaru view of supernova explosion mechanism (Dr. Maeda/Dr. Nomoto)
15	2012/8/13&20 issue	AERA (The Asahi Shimbun company)	Special Report "What is our Universe?" *Introducing Kavli IPMU as a cutting edge research center/ Interviewing with Associate Director Katayama and Dr.Komatsu
16	2012/9/13	The Yomiuri Shimbun/ The Nikkei Sangyo Shimbun	<Press Release: 2012/09/13> Hyper Suprime-Cam ushers in a new era of observational astronomy
17	2012/9/15 2012/9/25	The Tokyo Shimbun The Chunichi Shimbun	Catastrophic gamma rays from nearby supernova explosions? *Dr. NOMOTO talks about Supernovae explosion.
18	2012 September issue	Newton -Special issue-	Higgs boson - world of particle physics - *Director Murayama supervises the issue.
19	2012/10/22 issue	Nikkei Business	100 miraculous organizations in Japan *Introducing Kavli IPMU as a one of 100 amazing organizations
20	2012/11/11	The Yomiuri Shimbun	<Press Release: 2012/11/02> Dr. Hirosi Ooguri chosen for the Fellow of the American Mathematical Society
21	2012/8/1	Discovery Channel (Cable television)	Understanding the Universe *Director Murayama appeared as the program navigator.
22	2013/1/8	The Yomiuri Shimbun	Revive Japan! - my description *Director Murayama talks about Kavli IPMU and his idea about globally visible research center in Japan.
23	2013/2/11 issue	Weekly Economist -Special issue-	Entering the 21st Century, cosmology has changed dramatically *Interviewing with Director Murayama
24	2013/3/14	Cosmic Front (NHK)	First Star *Dr. Naoki Yoshida & Kavli IPMU are addressed.