

World Premier International Research Center Initiative (WPI)

FY2011 WPI Project Progress Report (Post-Interim Evaluation)

Host Institution	The University of Tokyo	Host Institution Head	Junichi Hamada
Research Center	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 2012.
- * 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 the space of this page)

Three underground experimental projects at the Kamioka observatory are all making substantial progress; KamLAND-Zen has started data taking and feasibility study for EGADS continue: XMASS took the first data in fall 2011. For Subaru telescope, new camera, HyperSuprimeCam, was installed and construction of a new multi-object spectrograph, PFS, moves forward. We are planning to participate in the Belle II experiment for the study of supersymmetry and physics beyond the Standard Model.

Data from Sloan Digital Sky Survey III and Subaru Telescope have been analyzed with strong and weak gravitational lensing techniques and revealed several interesting facts about the dark matter distributions around the galaxies. Detailed computer simulation of the evolving process of the universe revealed that dark matter played an important role when the first stars were formed in the early universe. We observed that carbon is present in many type Ia Supernovae, which was unexpected from a standard theory of the stellar explosion. We also detected dust particles from SN 1987A, demonstrating that the supernovae are major producers of dust in the universe.

We continue to work on interpretations of new LHC data and cosmic ray observations, particularly in connection with dark matter and physics beyond the Standard Model. Applications of string theory to other areas such as computation of particle masses and condensed-matter physics have been vigorously pursued.

In order to further encourage interdisciplinary research, we have added mathematics-astronomy seminars in fall 2011. The collaboration between mathematicians and astronomers is intended to develop new mathematical approaches in the gravitational lensing analysis and extract maximum amount of information from the data. In the study of mathematical theory of mirror symmetry, substantial progress has been made in the understanding of Calabi-Yau 3-fold and Gromov-Witten theory.

During FY 2011 IPMU hosted 12 conferences and workshops, and 196 seminars. Research activities at IPMU have resulted in 252 publications in the refereed journals. IPMU has exchange program with 16 foreign institutions (9 in the US, 6 in Europe, 1 in Asia). In some cases, the program includes exchange of students for training purposes. The FY 2010 creation of TODIAS provides a permanent place for IPMU within the university, and ways to permanently sustain IPMU beyond the WPI funding period are discussed. The University of Tokyo announced to accept a donation from Kavli Foundation and establish an endowment for IPMU, hence the name of the institution changes to "Kavli IPMU" starting April 1, 2012.

- 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

It is not easy for a newly established institute to experimentally or observationally tackle the questions of the universe as the projects have become larger and larger and need big collaborations to pursuit even a single parameter of fundamental physics. We have been fortunate because of the proximity to Institute for Cosmic Ray Research (ICRR) and faculty of science of University of Tokyo, and of good relationship with other collaborating institutions. We have spent considerable efforts to join, propose and lead the experiments. Now we are seeing the fruits.

Three underground experimental projects in which IPMU staff is actively participating at the Kamioka observatory are all making substantial progress. KamLAND-Zen (for detecting neutrinoless double beta decay of ^{136}Xe using KamLAND) reported results from the first batch of data; precise measurement of ordinary double beta decay half-life and a limit on the neutrinoless double beta decay, setting the most stringent limit on the Majoron coupling to the neutrino. Feasibility study for EGADS (for detecting relic supernova neutrinos using Super-Kamiokande) continue. The XMASS (for directly detecting dark matter particles in our galaxy using one ton liquid Xeon tank) took the first data in fall 2011. The data analysis and further tuning of the detector system is under way.

For a next-generation wide-field galaxy survey, the SuMIRe project (Subaru Measurement of Images and Redshifts) funded by the FIRST (Funding Program for World-Leading Innovative R&D on Science and Technology), the construction of new camera HSC (HyperSuprimeCam) was completed and the first light is scheduled in fall 2012 while the plan for constructing a new multi-object spectrograph PFS (PrimeFocusSpectrograph) moves forward. Three PFS collaboration meetings were held in FY 2011, one in June 2011, second one in January 2012 and third one in March 2012. During the third meeting, the conceptual design was thoroughly reviewed by an international committee and successfully passed the review. The project will now move to a next stage of detailed design and construction.

Data from Sloan Digital Sky Survey III and Subaru Telescope have been analyzed with strong and weak gravitational lensing techniques and revealed several interesting facts about the dark matter distributions around the galaxies: the degree of central concentration is in good agreement with the prediction of the standard model in which dark matter is assumed to be “cold”; the distribution is highly flattened as previously reported also from IPMU but using a different method. Detailed computer simulation of the first stars in the early universe showed that they could not grow much more than 40 times the solar mass, despite what had been believed, which shows better consistency with the observed abundance of

elements in metal-poor region. A combined study of the computer simulation and the gravitational lensing analysis showed that the galaxies have long outskirts of dark matter that extend as far as their nearby galaxies. It implies that the inter-galactic space is not empty but filled with dark matter. These findings are all new forefront advances for the investigation of the dark side of the universe.

We have found that carbon is present in many type Ia Supernovae, which was unexpected from a standard theory of the stellar explosion. The appearance of the carbon is diverse and seems related to the other diversity in their spectra. This might have important applications to the cosmology. Another important work related to the supernovae was the detection of dust particle from SN 1987A, demonstrating that the supernovae are major producers of dust in the universe.

We continue to work on interpretations of new LHC data and cosmic ray observations, particularly in connection with dark matter and physics beyond the Standard Model. A possible connection between dark matter identity and the conservation of $(B - L)$, the difference between the baryon and lepton numbers, was studied based on a conjecture that the dark matter particles must be stable on cosmological time scales and stability is often associated with some sort of symmetry. That had led to a conclusion that the dark matter particle must have a well defined mass, independent of the details of new physics. In another study of possible connection between symmetry and weakly interacting massive particle (WIMP) which is one of the most popular dark matter candidates, certain assumptions for the WIMP property has led to a prediction of the Higgs mass in the 120–125GeV range, consistent with the recent LHC results.

Applications of string theory to other areas such as computation of particle masses or condensed-matter physics have been vigorously pursued. Noteworthy is an interesting joint work on topological insulator between IPMU string theorists and condensed-matter physicists at the Institute for Solid State Physics (ISSP). Alternative quantum gravity theory that does not depend on string theory has been actively studied, and was shown to solve the horizon problem, one of the outstanding problems in cosmology.

In the study of mathematical theory of mirror symmetry, which is a deep connection among different geometric theories, substantial progress has been made in the understanding of Calabi-Yau 3-fold and Gromov-Witten theory. Work on homological algebra, which is another way for describing the mirror symmetry, is also vigorously pursued.

IPMU hosted 12 conferences and workshops, and 196 seminars. Research activities at IPMU have resulted in 252 publications in the refereed journals.

2. Advancing fusion of various research fields

In order to encourage interdisciplinary research, we have been regularly hosting joint seminars of different fields. Besides on-going mathematics-string theory seminar and astronomy-cosmology-particle physics seminar, we have started mathematics-astronomy seminar in fall 2011. The collaboration between mathematicians and astronomers is intended to develop new mathematical approaches in the gravitational lensing analysis and extract maximum amount of information from the data.

Collaboration continues between string theorists at IPMU and condensed-matter physicists at ISSP, our next-door neighbor on Kashiwa campus, on the topological insulator. One of their works has suggested a new method to search for axion, a hypothetical particle long sought by particle physicists without success. It is noteworthy that a joint work of string theory and condensed-matter theory suggests a new experimental realization of concepts in particle physics.

We have hosted several interdisciplinary workshops. Workshop "Curves and Categories in Geometry and Physics" provided a forum for mathematicians working on geometry and physicists working on string theory. The 6th Asian Winter School "Strings, Particles and Cosmology" was intended to introduce young people from Asia to interdisciplinary research at their early career stage. IPMU Workshop "Particle Physics of the Dark Universe" dealt with dark matter, which is obviously a common problem in particle physics 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

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 19 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 70 full time faculty and postdoctoral members, 40 are foreign. Out of 89 affiliate members, 34 are foreign. Also, we were visited by 630 researchers, of which 392 were foreign. Many of them are also world top-class scientists.

IPMU has exchange program with 16 foreign institutions (9 in the US, 6 in Europe, 1 in Asia). In some cases, the program includes exchange of students for training purposes.

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

IPMU hosted 12 workshops and conferences. Among the 807 participants, 286 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, IPMU researchers presented numerous talks and seminars at both foreign and domestic institutions and conferences. These activities helped to raise the visibility of 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)

IPMU policy that all research staff has to spend at least one month abroad each year provides an ample opportunity especially for young members to expose themselves by giving talks at conferences and seminars abroad. This greatly helps to raise their visibility in the international community and opportunity for subsequent career developments. The hiring for fall 2012 started from winter 2011, synched with the US schedule. We received more than 1,000 applicants, of which 800 were from abroad.

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.

The University of Tokyo announced to accept a donation from Kavli Foundation of the United States and establish an endowment for IPMU, hence the name of institution will be changed to Kavli IPMU starting April 1, 2012. This is the first such case among the national universities in Japan. Besides obvious benefits of securing some permanent fund and the prestige associated with the Kavli institutes, this provided a great opportunity for the university to reexamine and reform the systems for managing donated funds. Note that the acronym is not KIPMU, which undermines the attained name recognition of IPMU, but rather "Kavli IPMU" which maintains the IPMU name separate from Kavli.

In response to a recommendation from the Interim Evaluation that the university should give a certain number of tenure positions to IPMU, IPMU and the university administration have been discussing several innovative ideas for creating such positions. Many of them require reform in the system of human-resource-management. So far the university agreed to provide IPMU with up to 10 tenure positions of the president's discretion. The university is also committed to permanently sustain IPMU with 100% outside funding as long as such fund is secured. These efforts should have far-reaching consequences not only for other departments of the university but for other advanced institutes in Japan.

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

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. Future prospects are even brighter than originally anticipated due to: starting of the SuMIRe project that expands the scope of the large-scale galaxy survey; planned participation in the Belle II experiment for the study of supersymmetry and physics beyond the Standard Model; flourishing mathematics activities at Kashiwa campus far beyond our original expectation.

Our research organization also stays the same, in which research is conducted in a loosely-bound flat structure with the Principal Investigators taking leadership roles. This fiscal year we appointed a new

Principal Investigator in mathematics. A few faculty members left (or are in the process of leaving) IPMU to take higher positions elsewhere. But we were able to hire several extremely competitive members. At the postdoc level, we had more than 1,000 applicants this fiscal year alone. We believe that we have established our reputation as a very exciting and highly competitive institute.

Laboratory spaces on the first floor of the IPMU building are getting filled up with equipment in preparation for the Belle II experiment and PFS construction, which will pick up the momentum toward summer 2012.

- 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 FY 2010 creation of TODIAS provides a permanent place for IPMU within the university. The university has been extremely supportive for creating a scheme to permanently support IPMU within the framework of TODIAS. As was mentioned in the second paragraph of Section 4, so far the university agreed to provide IPMU with up to 10 tenure positions of the president's discretion. One was already filled and two more will be filled in FY 2012. The university is also committed to permanently sustain IPMU as long as the 100% outside funding is secured.

- 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 IPMU for a limited period in the event 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.

Setting up an objective method to evaluate our global standing is important. We have adopted a scheme in which papers written by the IPMU staff and appeared in the refereed journals are thoroughly searched by the research support staff. This scheme guarantees, with minimum burden to researchers, that the number of citations are routinely updated once the papers are registered as "IPMU papers" including those from the former members. This is useful for evaluating our global standing, at least in physics and astronomy but not necessarily in mathematics, as well as for following through the career development of former members.

For the evaluation of mathematics activity, we adopt an approach of peer review.

7. Center's response to interim evaluation

Transcribe each item from the "Actions Required and Recommendations" section and note how the center has responded to them. However, if you have already provided this information, please indicate where in the report.

1. *With the establishment of TODIAS, UT is in a position to give a certain number of tenured positions to IPMU. The committee anticipates that researchers may be concerned about their futures and leave IPMU for more secure positions. We recommend that UT should put some care into adopting a globally accepted meaning of "tenure".*

The tenure issue is a single most important issue we face now to sustain IPMU beyond the WPI funding. This was repeatedly brought up at the annual Follow-up Meetings. The fixed-term nature of the funding has been the biggest impediment in recruiting the best minds, as well as retention for the current members. Already four faculty members have left or are leaving shortly citing the lack of long-term job security. It is critical to identify paths to sustain IPMU in the long run. The creation of TODIAS is an essential part of the vision. It provides a permanent place for the IPMU on the organizational structure of the University.

As was mentioned in Section 4, the university has so far agreed to provide IPMU with up to 10 tenure positions of the president's discretion. One was already filled and two more will be filled in FY 2012. The university is also committed to permanently sustain IPMU as long as the 100% outside funding were secured. The university is making a serious effort to make more flexible system of human-resource-management so that it can support IPMU for a limited period in the event IPMU cannot sustain itself with external funds only.

We have been in constructive discussions with the university administration on this matter. They have innovative ideas to make IPMU permanent beyond the WPI funding: purely externally funded positions with many renewals beyond currently envisioned, endowment to support IPMU appointments and research, and possibly others. Many of them require reform in the current system of human-resource-management.

As a result of the effort by the University to build an endowment for the IPMU, the Kavli Foundation recently agreed to donate \$7.5M to build an endowment. It would provide research support for the IPMU in perpetuity at a few hundred thousand dollars level. We continue to make an appeal to promote further fundraising to boost the endowment.

2. *We strongly encourage foreign joint appointments at the faculty levels, which will enhance personnel exchanges. The director is a good example of this. Such appointments can offer benefits to the appointees.*

We will pursue new joint appointments with institutions outside Japan. Currently we have Ed Turner with Princeton, Sergey Petcov with SISSA (Trieste, Italy), Eiichiro Komatsu with Texas Austin, on similar arrangements.

3. *IPMU could leverage advances in data mining and informatics in pursuing forthcoming exciting HSC*

observational cosmology research.

We have conducted one workshop “Statistical Frontier of Astrophysics” which was highly successful. We will hold another one the next year to pursue this important subject. We are also looking for a faculty member who is interested in working at the interface.

8. Center’s response to the site-visit report used in the interim evaluation

Transcribe each item from the “7. Actions Required and Recommendations” section and note how the center has responded to them. However, if you have already provided this information, please indicate where in the report.

SUMMARY OF MOST URGENT RECOMMENDATIONS

1. *We mentioned in Sec. 4 (where they mentioned the following. “We strongly believe that IPMU needs at least four tenure positions, not including that of the director. These tenure positions can be funded (entirely, or partly) by research contracts but must be guaranteed by UT. There should be international competition for these positions, and IPMU should fill these positions with young PIs. We believe that, even at this stage, such IPMU positions are so prestigious that it can attract best candidates. And these faculties will be tremendous assets to UT”), because there is no tenure positions time is of the essence for IPMU.*

The university has so far agreed to provide IPMU with up to 10 tenure positions of the president’s discretion. One was already filled and two more will be filled in FY 2012. We seriously consider the recommendation that these positions should be used to attract young PIs and other outstanding scientists who can survive the international competition.

2. *Since IPMU succeeded in introducing the joint appointment system to Japan, it should work towards changing the kennin appointments to joint appointments. This is especially relevant to Japanese mathematicians and theoretical physicists. Note that kennin is different from joint appointment. By joint appointment, we mean a researcher’s time and salary are split by two or more institutions considering their contributions.*

We will pursue new joint appointments with institutions outside Japan. Currently we have Ed Turner with Princeton, Serguey Petcov with SISSA (Trieste, Italy), Eiichiro Komatsu with Texas Austin, on similar arrangements. Although we will give it a try, changing the kennin appointments to joint appointments among faculty members of Japanese universities will be very difficult.

3. *The number of non-Japanese on site PI’s should be increased, while the number of Japanese post-docs should be increased to have sound balance.*

We will seriously follow this advice of increasing on-site non-Japanese PIs and continue searching the candidates. For increasing Japanese post-docs, we follow the advice from both the site visit and the Subaru Advisory Committee and have been hiring mostly Japanese researchers through the SuMIRE Project funding. This helps increase the number of Japanese postdocs, in particular.

4. *Efforts are needed to increase domestic post-doc applications. This is important in order to bring good young people in Japan to IPMU so that they interact good young people from abroad.*

As mentioned in the above section, we hired mostly Japanese post-docs for the SuMIRe Project. This helped to increase the number of Japanese post-docs. In FY 2011, we received more than 1,000 applicants for the post-doc positions, of which 200 were Japanese. Although the fraction of Japanese stays same as before, the absolute number of applicants is definitely increasing.

IMPORTANCE OF STUDENTS

1. *The lifeblood of a research institute are its young people, and in particular its graduate students, and even undergraduate students. Graduate students are not only students; the best ones are very energetic and creative young researchers themselves. This is a relatively inexpensive resource the IPMU has unfortunately not tapped yet.*
2.
 - (a) *One way to mitigate and hence widen support for the WPI programs is to reach out to graduate students and faculty members in other universities in the area, e.g. Univ. of Tsukuba, Chiba Univ., Saitama Univ., Tokyo Univ. of Agriculture and Technology, Tokyo Gakugei Univ. Many will appreciate interaction with world-class scientists. Private funds can be used to offset their travel expenses.*
 - (b) *IPMU should also go after students worldwide. To bring in some of the world's best students and have them graduated under the guidance of the assistant, associate, and full professors, and the PIs. We recommend IPMU to establish an international, competitive scholarship scheme for exceptional graduate students. Internationalization of science starts early, and competing for and attracting some of the world's most gifted students would be a strong boost to the goals of the IPMU, and of immense long-term benefit to Japan. Why loose out to major US universities such as Princeton, the Canadian Premier Institute or the German Max-Planck society in this competition?*

IPMU has been steadily accepting increasingly more graduate students (FY2009, 9 from Physics Department and 2 from Astronomy Department; FY2010, 16 from Physics Department and 2 from Astronomy Department; FY2011, 16 from Physics Department, 4 from Astronomy Department, and 2 from Mathematics Department). Since IPMU started accepting 5-year graduate course students in FY2009, the number of students is not saturated yet. It will not be difficult to increase the number of students up to 30 or so, but further increase may require some new ideas.

We have accepted several graduate students as long-term visitors from both abroad and Japan. They usually come to IPMU because of their adviser's collaborative work with IPMU. However, we have not explored a possibility for just accepting students from the neighboring universities and foreign universities. It is certainly an interesting possibility and we give a serious consideration.

3. *Interdisciplinary science may be introduced early. IPMU may also consider one or two week course, bringing together mathematics and physics undergraduate students.*

Graduate students at IPMU can attend all the seminars, and also they enjoy every-day tea time which all

IPMU members join. On these occasions they can easily communicate with researchers and students in other fields. On the other hand, according to our understanding of the WPI policy, it is not allowed for the WPI centers to educate undergraduate students. If this restriction should be relaxed, we would be happy to provide opportunities to undergraduate students in mathematics, physics, and cosmology, so that they can make communication between these fields.

ON KAVLI INSTITUTE

We have learnt that IPMU and UT wish to join the distinctive list of Kavli Institutes. It requires changing the name IPMU to Kavli Institute for Physics and Mathematics of the Universe. In spite of this name change, which is admittedly of some concern to some of the working group members, we hope that the prestige associated with the Kavli institutes will help to preserve the long-term success of the IPMU. In turn, the IPMU membership might increase the success of the family of Kavli institutes.

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List of Center's Research Results and Main Awards

A. Published Papers

- List in order of most recent the Center's papers published in refereed journals during FY2011.
- For each, write the paper title; author name(s); journal name, volume, page(s); and publication year. If there are a few authors, underline those affiliated with the Center. (Any order may be used as long as format is the same.)
- If there are many authors, show and underline those affiliated with the Center, cutting out the names of other authors as deemed appropriate.
- For the most important papers, shade in the number block. For papers giving the results of fusion research, underline the number in the block.
- If the list exceeds this form, please add extra pages.

No.	Author names and details
1	Stability conditions and curve counting invariants on Calabi-Yau 3-folds Yukinobu Toda Kyoto Journal of Mathematics 52(1), pp. 1-50, SPR, 2012
2	DIVERSITY OF LUMINOUS SUPERNOVAE FROM NON-STEADY MASS LOSS Takashi J Moriya, Nozomu Tominaga Astrophysical Journal 747(2), 118, MAR 10, 2012
3	SIMULATIONS OF EARLY BARYONIC STRUCTURE FORMATION WITH STREAM VELOCITY. I. HALO ABUNDANCE Smadar Naoz, <u>Naoki Yoshida</u> , Nickolay Y Gnedin Astrophysical Journal 747(2), 128, MAR 10, 2012
4	Comments on worldsheet description of the Omega background Yu Nakayama, Hiroshi Ooguri Nuclear Physics B 856(2), pp. 342-359, MAR 11, 2012
5	Extra matters decree the relatively heavy Higgs of mass about 125 GeV in the supersymmetric model Takeo Moroi, Ryosuke Sato, Tsutomu T Yanagida Physics Letters B 709(3), pp. 218-221, MAR 19, 2012
6	A note on Kahler potential of charged matter in F-theory Teruhiko Kawano, Yoichi Tsuchiya, Taizan Watari Physics Letters B 709(3), pp. 254-259, MAR 19, 2012
7	DARK ENERGY FROM THE LOG-TRANSFORMED CONVERGENCE FIELD Hee-Jong Seo, Masanori Sato, Masahiro Takada, Scott Dodelson Astrophysical Journal 748(1), 57, MAR 20, 2012
8	Supernova relic neutrino search at super-Kamiokande K Bays, T Iida, <u>K Abe</u> , <u>Y Hayato</u> , K Iyogi, <u>J Kameda</u> , <u>Y Koshio</u> , L Marti, M Miura, <u>S Moriyama</u> , <u>M Nakahata</u> , <u>S Nakayama</u> , <u>Y Obayashi</u> , <u>H Sekiya</u> , <u>M Shiozawa</u> , <u>Y Suzuki</u> , <u>A Takeda</u> , Y Takenaga, K Ueno, K Ueshima, S Yamada, T Yokozawa, H Kaji, <u>T Kajita</u> , K Kaneyuki, T McLachlan, K Okumura, K. P Lee, <u>K Martens</u> , <u>M Vagins</u> , L Labarga, <u>E Kearns</u> , M Litos, J. L Raaf, <u>J. L Stone</u> , L. R Sulak, W. R Kropp, S Mine, C Regis, A Renshaw, <u>M. B Smy</u> , <u>H. W Sobel</u> , K. S Ganezer, J Hill, W. E Keig, S Cho, J. S Jang, J. Y Kim, I. T Lim, J Albert, <u>K Scholberg</u> , <u>C. W Walter</u> , R Wendell, T Wongjirad, T Ishizuka, S Tasaka, J. G Learned, S Matsuno, S Smith, T Hasegawa, T Ishida, T Ishii, T Kobayashi, T Nakadaira, <u>K Nakamura</u> , K Nishikawa, Y Oyama, K Sakashita, T Sekiguchi, T Tsukamoto, A. T Suzuki, <u>Y Takeuchi</u> , M Ikeda, K Matsuoka, A Minamino, A Murakami, T Nakaya, Y Fukuda, Y Itow, G Mitsuka, M Miyake, T Tanaka, J Hignight, J Imber, C. K Jung, I Taylor, C Yanagisawa, A Kibayashi, H Ishino, S Mino, M Sakuda, T Mori, H Toyota, Y Kuno, S. B Kim, B. S Yang, H Okazawa, Y Choi, K Nishijima, M Koshiba, Y Totsuka, <u>M Yokoyama</u> , Y Heng, S Chen, H Zhang, Z Yang, P Mijakowski, K Connolly, M Dziomba, R. J Wilkes Physical Review D 85(5), 052007, MAR 22, 2012
9	Large mixing angles from many right-handed neutrinos Brian Feldstein, William Klemm Physical Review D 85(5), 053007, MAR 27, 2012
10	General relativity limit of Horava-Lifshitz gravity with a scalar field in gradient expansion A. Emir Guemruekcueoglu, Shinji Mukohyama, Anzhong Wang Physical Review D 85(6), 064042, MAR 28, 2012

11	Impact of massive neutrinos on the abundance of massive clusters Kiyotomo Ichiki, Masahiro Takada Physical Review D 85(6), 063521, MAR 30, 2012
12	Cosmological perturbations of self-accelerating universe in nonlinear massive gravity A. Emir Guemruekcueoglu, Chunshan Lin, Shinji Mukohyama Journal of Cosmology and Astroparticle Physics (3), 006, MAR, 2012
13	Dark radiation from modulated reheating Takeshi Kobayashi, Fuminobu Takahashi, Tomo Takahashi, Masahide Yamaguchi Journal of Cosmology and Astroparticle Physics (3), 036, MAR, 2012
14	The effect of C-12+C-12 rate uncertainties on the evolution and nucleosynthesis of massive stars M. E Bennett, <u>R Hirschi</u> , M Pignatari, S Diehl, C Fryer, F Herwig, A Hungerford, <u>K Nomoto</u> , G Rockefeller, F. X Timmes, M Wiescher Monthly Notices of the Royal Astronomical Society 420(4), pp. 3047-3070, MAR, 2012
15	Combined strong and weak lensing analysis of 28 clusters from the Sloan Giant Arcs Survey <u>Masamune Oguri</u> , Matthew B Bayliss, Hakon Dahle, Keren Sharon, Michael D Gladders, Priyamvada Natarajan, Joseph F Hennawi, Benjamin P Koester Monthly Notices of the Royal Astronomical Society 420(4), pp. 3213-3239, MAR, 2012
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197	Wall Crossing and M-Theory <u>Mina Aganagic</u> , Hiroshi Ooguri, Cumrun Vafa, <u>Masahito Yamazaki</u> Publications of the Research Institute For Mathematical Sciences 47(2), pp. 569-584, JUN, 2011
198	Algebraic Analysis of Minimal Representations Toshiyuki Kobayashi Publications of the Research Institute For Mathematical Sciences 47(2), pp. 585-611, JUN, 2011

199	Baryogenesis from Dark Sector Naoyuki Haba, <u>Sigeki Matsumoto</u> Progress of Theoretical Physics 125(6), pp. 1311-1316, JUN, 2011
200	Optical studies of SN 2009jf: a Type Ib supernova with an extremely slow decline and aspherical signature D. K Sahu, U. K Gurugubelli, G. C Anupama, <u>K Nomoto</u> Monthly Notices of the Royal Astronomical Society 413(4), pp. 2583-2594, JUN, 2011
201	Effects of the explosion asymmetry and viewing angle on the Type Ia supernova colour and luminosity calibration <u>Keiichi Maeda</u> , Giorgos Leloudas, Stefan Taubenberger, Maximilian Stritzinger, Jesper Sollerman, Nancy Elias-Rosa, Stefano Benetti, Mario Hamuy, <u>Gaston Folatelli</u> , Paolo A Mazzali Monthly Notices of the Royal Astronomical Society 413(4), pp. 3075-3094, JUN, 2011
202	Future oscillations around phantom divide in $f(R)$ gravity Hayato Motohashi, Alexei A Starobinsky, <u>Jun'ichi Yokoyama</u> Journal of Cosmology and Astroparticle Physics (6), 006, JUN, 2011
203	The pairwise velocity probability density function in models with local primordial non-Gaussianity Tsz Yan Lam, Takahiro Nishimichi, Naoki Yoshida Monthly Notices of the Royal Astronomical Society 414(1), pp. 289-303, JUN, 2011
204	On the second rational K-group of an elliptic curve over global fields of positive characteristic <u>Satoshi Kondo</u> , Seidai Yasuda Proceedings of the London Mathematical Society 102, pp. 1053-1098, JUN, 2011
205	Inverse seesaw in supersymmetry Park, Seong Chan; Wang, Kai PHYSICS LETTERS B 701(1), pp. 107-110, JUN 27, 2011
206	Top quark polarization as a probe of models with extra gauge bosons Berger, Edmond L.; Cao, Qing-Hong; <u>Chen, Chuan-Ren</u> ; Zhang, Hao PHYSICAL REVIEW D 83(11), 114026, JUN 13, 2011
207	A MULTIBAND STUDY OF THE GALAXY POPULATIONS OF THE FIRST FOUR SUNYAEV-ZEL'DOVICH EFFECT SELECTED GALAXY CLUSTERS Zenteno, A.; Song, J.; Desai, S.; Armstrong, R.; Mohr, J. J.; Ngeow, C. -C.; Barkhouse, W. A.; Allam, S. S.; Andersson, K.; Bazin, G.; Benson, B. A.; Bertin, E.; Brodwin, M.; Buckley-Geer, E. J.; Hansen, S. M.; High, F. W.; Lin, H.; <u>Lin, Y. -T.</u> ; Liu, J.; Rest, A.; Smith, R. C.; Stalder, B.; Stark, A. A.; Tucker, D. L.; Yang, Y. ASTROPHYSICAL JOURNAL 734(1), 3, JUN 10, 2011
208	Spinning super-massive objects in galactic nuclei up to $a^{(*)} > 1$ Bambi, C. EPL 94(5), 50002, JUN, 2011
209	THE ATACAMA COSMOLOGY TELESCOPE: COSMOLOGY FROM GALAXY CLUSTERS DETECTED VIA THE SUNYAEV-ZEL'DOVICH EFFECT Neelima Sehgal, Hy Trac, Viviana Acquaviva, Peter A. R Ade, Paula Aguirre, Mandana Amiri, John W Appel, L Felipe Barrientos, Elia S Battistelli, J. Richard Bond, Ben Brown, Bryce Burger, Jay Chervenak, Sudeep Das, Mark J Devlin, Simon R Dicker, W. Bertrand Doriese, Joanna Dunkley, Rolando Duenner, Thomas Essinger-Hileman, Ryan P Fisher, Joseph W Fowler, Amir Hajian, Mark Halpern, Matthew Hasselfield, Carlos Hernandez-Monteagudo, Gene C Hilton, Matt Hilton, Adam D Hincks, Renee Hlozek, David Holtz, Kevin M Huffenberger, David H Hughes, John P Hughes, Leopoldo Infante, Kent D Irwin, Andrew Jones, Jean Baptiste Juin, Jeff Klein, Arthur Kosowsky, Judy M Lau, Michele Limon, Yen-Ting Lin, Robert H Lupton, Tobias A Marriage, Danica Marsden, Krista Martocci, Phil Mauskopf, Felipe Menanteau, Kavilan Moodley, Harvey Moseley, Calvin B Netterfield, Michael D Niemack, Michael R Nolta, Lyman A Page, Lucas Parker, Bruce Partridge, Beth Reid, Blake D Sherwin, Jon Sievers, David N Spergel, Suzanne T Staggs, Daniel S Swetz, Eric R Switzer, Robert Thornton, Carole Tucker, Ryan Warne, Ed Wollack, Yue Zhao Astrophysical Journal 732(1), 44, MAY 1, 2011
210	EARLY-TYPE GALAXIES AT z similar to 1.3. II. MASSES AND AGES OF EARLY-TYPE GALAXIES IN DIFFERENT ENVIRONMENTS AND THEIR DEPENDENCE ON STELLAR POPULATION MODEL ASSUMPTIONS A Raichoor, S Mei, F Nakata, S. A Stanford, B. P Holden, A Rettura, M Huertas-Company, M Postman, P Rosati, J. P Blakeslee, R Demarco, P Eisenhardt, G Illingworth, M. J Jee, T Kodama, <u>M</u>

	<p><u>Tanaka</u>, R. L White Astrophysical Journal 732(1), 12, MAY 1, 2011</p>
211	<p>The Japanese space gravitational wave antenna: DECIGO Seiji Kawamura, Masaki Ando, Naoki Seto, Shuichi Sato, Takashi Nakamura, Kimio Tsubono, Nobuyuki Kanda, Takahiro Tanaka, <u>Jun'ichi Yokoyama</u>, Ikkoh Funaki, Kenji Numata, Kunihito Ioka, Takeshi Takashima, Kazuhiro Agatsuma, Tomotada Akutsu, Koh-suke Aoyanagi, Koji Arai, Akito Araya, Hideki Asada, Yoichi Aso, Dan Chen, Takeshi Chiba, Toshikazu Ebisuzaki, Yumiko Ejiri, Motohiro Enoki, Yoshiharu Eriguchi, Masa-Katsu Fujimoto, Ryuichi Fujita, Mitsuhiro Fukushima, Toshifumi Futamase, Tomohiro Harada, Tatsuaki Hashimoto, Kazuhiro Hayama, Wataru Hikida, Yoshiaki Himemoto, Hisashi Hirabayashi, Takashi Hiramatsu, Feng-Lei Hong, Hideyuki Horisawa, Mizuhiko Hosokawa, Kiyotomo Ichiki, Takeshi Ikegami, Kaiki T Inoue, Koji Ishidoshiro, Hideki Ishihara, Takehiko Ishikawa, Hideharu Ishizaki, Hiroyuki Ito, Yousuke Itoh, Kiwamu Izumi, Isao Kawano, Nobuki Kawashima, Fumiko Kawazoe, Naoko Kishimoto, Kenta Kiuchi, Shiho Kobayashi, Kazunori Kohri, Hiroyuki Koizumi, Yasufumi Kojima, Keiko Kokeyama, Wataru Kokuyama, Kei Kotake, Yoshihide Kozai, Hiroo Kunimori, Hitoshi Kuninaka, Kazuaki Kuroda, Sachiko Kuroyanagi, Kei-ichi Maeda, Hideo Matsuhara, Nobuyuki Matsumoto, Yuta Michimura, Osamu Miyakawa, Umpei Miyamoto, Shinji Miyoki, Mutsuko Y Morimoto, Toshiyuki Morisawa, Shigenori Moriwaki, Shinji Mukohyama, Mitsuru Musha, Shigeo Nagano, Isao Naito, Kouji Nakamura, Hiroyuki Nakano, Kenichi Nakao, Shinichi Nakasuka, Yoshinori Nakayama, Kazuhiro Nakazawa, Erina Nishida, Kazutaka Nishiyama, Atsushi Nishizawa, Yoshito Niwa, Taiga Noumi, Yoshiyuki Obuchi, Masatake Ohashi, Naoko Ohishi, Masashi Ohkawa, Kenshi Okada, Norio Okada, Kenichi Oohara, Norichika Sago, Motoyuki Saijo, Ryo Saito, Masaaki Sakagami, Shin-ichiro Sakai, Shihori Sakata, Misao Sasaki, Takashi Sato, Masaru Shibata, Hisaaki Shinkai, Ayaka Shoda, Kentaro Somiya, Hajime Sotani, Naoshi Sugiyama, Yudai Suwa, Rieko Suzuki, Hideyuki Tagoshi, Fuminobu Takahashi, Kakeru Takahashi, Keitaro Takahashi, Ryutaro Takahashi, Ryuichi Takahashi, Tadayuki Takahashi, Hirotaka Takahashi, Takamori Akiteru, Tadashi Takano, Nobuyuki Tanaka, Keisuke Taniguchi, Atsushi Taruya, Hiroyuki Tashiro, Yasuo Torii, Morio Toyoshima, Shinji Tsujikawa, Yoshiki Tsunesada, Akitoshi Ueda, Ken-ichi Ueda, Masayoshi Utashima, Yaka Wakabayashi, Kent Yagi, Hiroshi Yamakawa, Kazuhiro Yamamoto, Toshitaka Yamazaki, Chul-Moon Yoo, Shijun Yoshida, Taizoh Yoshino, Ke-Xun Sun Classical and Quantum Gravity 28(9), 094011, MAY 7, 2011</p>
212	<p>EARLY-TYPE GALAXIES AT z similar to 1.3. III. ON THE DEPENDENCE OF FORMATION EPOCHS AND STAR FORMATION HISTORIES ON STELLAR MASS AND ENVIRONMENT A Rettura, S Mei, S. A Stanford, A Raichoor, S Moran, B Holden, P Rosati, R Ellis, F Nakata, M Nonino, T Treu, J. P Blakeslee, R Demarco, P Eisenhardt, H. C Ford, R. A. E Fosbury, G Illingworth, M Huertas-Company, M. J Jee, T Kodama, M Postman, <u>M Tanaka</u>, R. L White Astrophysical Journal 732(2), 94, MAY 10, 2011</p>
213	<p>Number-theory dark matter Kazunori Nakayama, Fuminobu Takahashi, Tsutomu T Yanagida Physics Letters B 699(5), pp. 360-363, MAY 23, 2011</p>
214	<p>Primordial non-Gaussianity from G inflation Tsutomu Kobayashi, <u>Masahide Yamaguchi</u>, <u>Jun'ichi Yokoyama</u> Physical Review D 83(10), 103524, MAY 24, 2011</p>
215	<p>Forecasting the cosmological constraints with anisotropic baryon acoustic oscillations from multipole expansion Atsushi Taruya, Shun Saito, Takahiro Nishimichi Physical Review D 83(10), 103527, MAY 27, 2011</p>
216	<p>Astroparticle physics with solar neutrinos Masayuki Nakahata Proceedings of the Japan Academy Series B-Physical and Biological Sciences 87(5), pp. 215-229, MAY, 2011</p>
217	<p>Split Generation in the SUSY Mass Spectrum and B-s(B)over-bar(s) Mixing Motoi Endo, Satoshi Shirai, <u>Tsutomu T Yanagida</u> Progress of Theoretical Physics 125(5), pp. 921-932, MAY, 2011</p>

218	The Effect of Varying Sound Velocity on Primordial Curvature Perturbations Masahiro Nakashima, <u>Ryo Saito</u> , Yu-ichi Takamizu, <u>Jun'ichi Yokoyama</u> Progress of Theoretical Physics 125(5), pp. 1035-1052, MAY, 2011
219	Warm Dirac-Born-Infeld inflation Cai, Yi-Fu; Dent, James B.; <u>Easson, Damien A.</u> PHYSICAL REVIEW D 83(10), 101301, MAY 19, 2011
220	Top Quark Forward-Backward Asymmetry and Same-Sign Top Quark Pairs Berger, Edmond L.; Cao, Qing-Hong; <u>Chen, Chuan-Ren</u> ; Li, Chong Sheng; Zhang, Hao PHYSICAL REVIEW LETTERS 106(20), 201801, MAY 17, 2011
221	Identifying the Inflaton with Primordial Gravitational Waves <u>Easson, Damien A.</u> ; Powell, Brian A. PHYSICAL REVIEW LETTERS 106(19), 191302, MAY 11, 2011
222	Constraint on the quadrupole moment of super-massive black hole candidates from the estimate of the mean radiative efficiency of AGN Bambi, Cosimo PHYSICAL REVIEW D 83(10), 103003, MAY 10, 2011
223	Evolution of the spin parameter of accreting compact objects with non-Kerr quadrupole moment Bambi, Cosimo JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS (5), 9, MAY, 2011
224	Measuring coherent motions in the universe <u>Song, Yong-Seon</u> ; Sabiu, Cristiano G.; Kayo, Issha; Nichol, Robert C. JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS (5), 20, MAY, 2011
225	CHEMICAL ENRICHMENT IN THE CARBON-ENHANCED DAMPED Ly alpha SYSTEM BY POPULATION III SUPERNOVAE Chiaki Kobayashi, Nozomu Tominaga, Ken'ichi Nomoto Astrophysical Journal Letters 730(2), L14, APR 1, 2011
226	Holography and Entanglement in Flat Spacetime Wei Li, Tadashi Takayanagi Physical Review Letters 106(14), 141301, APR 5, 2011
227	ROLE OF LINE-OF-SIGHT COSMIC-RAY INTERACTIONS IN FORMING THE SPECTRA OF DISTANT BLAZARS IN TeV GAMMA RAYS AND HIGH-ENERGY NEUTRINOS Warren Essey, Oleg Kalashev, <u>Alexander Kusenko</u> , John F Beacom Astrophysical Journal 731(1), 51, APR 10, 2011
228	Higgs G inflation Kohei Kamada, Tsutomu Kobayashi, Masahide Yamaguchi, <u>Jun'ichi Yokoyama</u> Physical Review D 83(8), 083515, APR 18, 2011
229	CONSTRAINING THE QUADRUPOLE MOMENT OF STELLAR-MASS BLACK HOLE CANDIDATES WITH THE CONTINUUM FITTING METHOD Cosimo Bambi, Enrico Barausse Astrophysical Journal 731(2), 121, APR 20, 2011
230	THE ATACAMA COSMOLOGY TELESCOPE: EXTRAGALACTIC SOURCES AT 148 GHz IN THE 2008 SURVEY Tobias A Marriage, Jean Baptiste Juin, Yen-Ting Lin, Danica Marsden, Michael R Nolta, Bruce Partridge, Peter A. R Ade, Paula Aguirre, Mandana Amiri, John William Appel, L Felipe Barrientos, Elia S Battistelli, John R Bond, Ben Brown, Bryce Burger, Jay Chervenak, Sudeep Das, Mark J Devlin, Simon R Dicker, W. Bertrand Doriese, Joanna Dunkley, Rolando Duennen, Thomas Essinger-Hileman, Ryan P Fisher, Joseph W Fowler, Amir Hajian, Mark Halpern, Matthew Hasselfield, Carlos Hernandez-Montegudo, Gene C Hilton, Matt Hilton, Adam D Hincks, Renee Hlozek, Kevin M Huffenberger, David Handel Hughes, John P Hughes, Leopoldo Infante, Kent D Irwin, Madhuri Kaul, Jeff Klein, Arthur Kosowsky, Judy M Lau, Michele Limon, Robert H Lupton, Krista Martocci, Phil Mauskopf, Felipe Menanteau, Kavilan Moodley, Harvey Moseley, Calvin B Netterfield, Michael D Niemack, Lyman A Page, Lucas Parker, Hernan Quintana, Beth Reid, Neelima Sehgal, Blake D Sherwin, Jon Sievers, <u>David N Spergel</u> , Suzanne T Staggs, Daniel S Swetz, Eric R Switzer, Robert Thornton, Hy Trac, Carole Tucker, Ryan Warne, Grant Wilson, Ed Wollack, Yue Zhao Astrophysical Journal 731(2), 100, APR 20, 2011

231	Why have supersymmetric particles not been observed? Fuminobu Takahashi, Tsutomu T Yanagida Physics Letters B 698(5), pp. 408-410, APR 25, 2011
232	Tracing the redshift evolution of Hubble parameter with gravitational-wave standard sirens Atsushi Nishizawa, Atsushi Taruya, Shun Saito Physical Review D 83(8), 084045, APR 26, 2011
233	Imprints of fast-rotating massive stars in the Galactic Bulge Cristina Chiappini, Urs Frischknecht, Georges Meynet, <u>Raphael Hirschi</u> , Beatriz Barbuy, Marco Pignatari, Thibaut Decressin, Andre Maeder Nature 472(7344), pp. 454-457, APR 28, 2011
234	THE EIGHTH DATA RELEASE OF THE SLOAN DIGITAL SKY SURVEY: FIRST DATA FROM SDSS-III <u>Hiroaki Aihara</u> , Carlos Allende Prieto, Deokkeun An, Scott F Anderson, Eric Aubourg, Eduardo Balbinot, Timothy C Beers, Andreas A Berlind, Steven J Bickerton, Dmitry Bizyaev, Michael R Blanton, John J Bochanski, Adam S Bolton, Jo Bovy, W. N Brandt, J Brinkmann, Peter J Brown, Joel R Brownstein, Nicolas G Busca, Heather Campbell, Michael A Carr, Yanmei Chen, Cristina Chiappini, Johan Comparat, Natalia Connolly, Marina Cortes, Rupert A. C Croft, Antonio J Cuesta, Luiz N da Costa, James R. A Davenport, Kyle Dawson, Saurav Dhital, Anne Ealet, Garrett L Ebelke, Edward M Edmondson, Daniel J Eisenstein, Stephanie Escoffier, Massimiliano Esposito, Michael L Evans, Xiaohui Fan, Bruno Femenia Castella, Andreu Font-Ribera, Peter M Frinchaboy, Jian Ge, Bruce A Gillespie, G Gilmore, Jonay I Gonzalez Hernandez, J. Richard Gott, Andrew Gould, Eva K Grebel, James E Gunn, Jean-Christophe Hamilton, Paul Harding, David W Harris, Suzanne L Hawley, Frederick R Hearty, Shirley Ho, David W Hogg, Jon A Holtzman, Klaus Honscheid, Naohisa Inada, Inese I Ivans, Linhua Jiang, Jennifer A Johnson, Cathy Jordan, Wendell P Jordan, Eyal A Kazin, David Kirkby, Mark A Klaene, G. R Knapp, Jean-Paul Kneib, C. S Kochanek, Lars Koesterke, Juna A Kollmeier, Richard G Kron, Hubert Lampeitl, Dustin Lang, Jean-Marc Le Goff, Young Sun Lee, Yen-Ting Lin, Daniel C Long, Craig P Loomis, Sara Lucatello, Britt Lundgren, Robert H Lupton, Zhibo Ma, Nicholas MacDonald, Suvrath Mahadevan, Marcio A. G Maia, Martin Makler, Elena Malanushenko, Viktor Malanushenko, Rachel Mandelbaum, Claudia Maraston, Daniel Margala, Karen L Masters, Cameron K McBride, Peregrine M McGehee, Ian D McGreer, Brice Menard, Jordi Miralda-Escude, Heather L Morrison, F Mullally, Demitri Muna, Jeffrey A Munn, Hitoshi Murayama, Adam D Myers, Tracy Naugle, Angelo Fausti Neto, Duy Cuong Nguyen, Robert C Nichol, Robert W O'Connell, Ricardo L. C Ogando, Matthew D Olmstead, Daniel J Oravetz, Nikhil Padmanabhan, Nathalie Palanque-Delabrouille, Kaike Pan, Parul Pandey, Isabelle Paris, Will J Percival, Patrick Petitjean, Robert Pfaffenberger, Janine Pforr, Stefanie Phleps, Christophe Pichon, Matthew M Pieri, Francisco Prada, Adrian M Price-Whelan, M. Jordan Raddick, Beatriz H. F Ramos, Celine Reyle, James Rich, Gordon T Richards, Hans-Walter Rix, Annie C Robin, Helio J Rocha-Pinto, Constance M Rockosi, Natalie A Roe, Emmanuel Rollinde, Ashley J Ross, Nicholas P Ross, Bruno M Rossetto, Ariel G Sanchez, Conor Sayres, David J Schlegel, Katharine J Schlesinger, Sarah J Schmidt, Donald P Schneider, Erin Sheldon, Yiping Shu, Jennifer Simmerer, Audrey E Simmons, Thirupathi Sivarani, Stephanie A Snedden, Jennifer S Sobek, Matthias Steinmetz, Michael A Strauss, Alexander S Szalay, Masayuki Tanaka, Aniruddha R Thakar, Daniel Thomas, Jeremy L Tinker, Benjamin M Tofflemire, Rita Tojeiro, Christy A Tremonti, Jan Vandenberg, M. Vargas Magana, Licia Verde, Nicole P Vogt, David A Wake, Ji Wang, Benjamin A Weaver, David H Weinberg, Martin White, Simon D. M White, Brian Yanny, <u>Naoki Yasuda</u> , Christophe Yèche, Idit Zehavi Astrophysical Journal Supplement Series 193(2), 29, APR, 2011
235	Gravitino dark matter and light gluino in an R-invariant low scale gauge mediation <u>Masahiro Ibe</u> , <u>Ryosuke Sato</u> , Tsutomu T Yanagida, Kazuya Yonekura Journal of High Energy Physics (4), 077, APR, 2011
236	Holographic conductivity in disordered systems Shinsei Ryu, <u>Tadashi Takayanagi</u> , Tomonori Ugajin Journal of High Energy Physics (4), 115, APR, 2011

237	<p>The zCOSMOS-Bright survey: the clustering of early and late galaxy morphological types since z similar or equal to 1 S de la Torre, O Le Fevre, C Porciani, L Guzzo, B Meneux, U Abbas, L Tasca, C. M Carollo, T Contini, J. -P Kneib, S. J Lilly, V Mainieri, A Renzini, M Scodreggio, G Zamorani, S Bardelli, M Bolzonella, A Bongiorno, K Caputi, G Coppa, O Cucciati, L de Ravel, P Franzetti, B Garilli, C Halliday, A Iovino, P Kampczyk, C Knobel, A. M Koekemoer, K Kovac, F Lamareille, J. -F Le Borgne, V Le Brun, C Maier, M Mignoli, R Pello, Y Peng, E Perez-Montero, E Ricciardelli, <u>J Silverman</u>, <u>M Tanaka</u>, L Tresse, D Vergani, E Zucca, D Bottini, A Cappi, P Cassata, A Cimatti, A Leauthaud, D Maccagni, C Marinoni, H. J McCracken, P Memeo, P Oesch, L Pozzetti, R Scaramella Monthly Notices of the Royal Astronomical Society 412(2), pp. 825-834, APR, 2011</p>
238	<p>Supernova dust for the extinction law in a young infrared galaxy at z similar to 1 K Kawara, <u>H Hirashita</u>, <u>T Nozawa</u>, T Kozasa, S Oyabu, Y Matsuoka, T Shimizu, H Sameshima, N Ienaka Monthly Notices of the Royal Astronomical Society 412(2), pp. 1070-1080, APR, 2011</p>
239	<p>Direct observational evidence for a large transient galaxy population in groups at 0.851 Michael L Balogh, Sean L McGee, David J Wilman, Alexis Finoguenov, Laura C Parker, Jennifer L Connelly, John S Mulchaey, Richard G Bower, <u>Masayuki Tanaka</u>, Stefania Giodini Monthly Notices of the Royal Astronomical Society 412(4), pp. 2303-2317, APR, 2011</p>
240	<p>Product structures in motivic cohomology and higher Chow groups Satoshi Kondo, Seidai Yasuda Journal of Pure and Applied Algebra 215(4), pp. 511-522, APR, 2011</p>
241	<p>Toric Methods in F-Theory Model Building Johanna Knapp, Maximilian Kreuzer Advances in High Energy Physics , 513436, , 2011</p>
242	<p>An integral formula for L-2-eigenfunctions of a fourth-order Bessel-type differential operator Toshiyuki Kobayashi, Jan Moellers Integral Transforms and Special Functions 22(7), pp. 521-531, , 2011</p>
243	<p>Linear Term Inflation from Running Kinetic Term in Supergravity Fuminobu Takahashi Progress of Theoretical Physics Supplement (190), pp. 26-32, , 2011</p>
244	<p>Aspects of Hybrid Inflation in Supergravity Kazunori Nakayama, Fuminobu Takahashi, Tsutomu T Yanagida Progress of Theoretical Physics Supplement (190), pp. 42-49, , 2011</p>
245	<p>Cosmological Perturbations in General Modified Gravity Theories Shinji Tsujikawa, Antonio De Felice, Shinji Mukohyama Progress of Theoretical Physics Supplement (190), pp. 188-196, , 2011</p>
246	<p>Numerical Study of Q-Ball Formation in Gravity Mediation Takashi Hiramatsu, Masahiro Kawasaki, Fuminobu Takahashi Progress of Theoretical Physics Supplement (190), pp. 229-238, , 2011</p>
247	<p>Time-Dependent Holography and Emergent Black Holes on D-Branes Tadashi Takayanagi Progress of Theoretical Physics Supplement (190), pp. 304-315, , 2011</p>
248	<p>First Detection of Ar-K Line Emission from the Cygnus Loop Hiroyuki Uchida, Hiroshi Tsunemi, Nozomu Tominaga, Satoru Katsuda, Masashi Kimura, Hiroko Kosugi, Hiroaki Takahashi, Satoru Takakura Publications of the Astronomical Society of Japan 63(1), pp. 199-208, , 2011</p>
249	<p>First On-Site Data Analysis System for Subaru/Suprime-Cam Hisanori Furusawa, Yuki Okura, Sogo Mineo, Tadafumi Takata, Fumiaki Nakata, Manobu Tanaka, Nobuhiko Katayama, Ryosuke Itoh, Naoki Yasuda, Satoshi Miyazaki, Yutaka Komiyama, Yousuke Utsumi, Tomohisa Uchida, Hiroaki Aihara Publications of the Astronomical Society of Japan 63, pp. S585-S603, , 2011</p>
250	<p>Early Science Result from the Japanese Virtual Observatory: AGN and Galaxy Clustering at $z=0.3$ to 3.0 Yuji Shirasaki, Masahiro Tanaka, Masatoshi Ohishi, Yoshihiko Mizumoto, Naoki Yasuda, Tadafumi Takata Publications of the Astronomical Society of Japan 63, pp. S469-S491, , 2011</p>

251	Schrodinger-like Dilaton Gravity Yu Nakayama Symmetry Integrability and Geometry-Methods and Applications 7, 014, , 2011
252	LIGHT GAUGINO PROBLEM IN DIRECT GAUGE MEDIATION Ookouchi, Yutaka INTERNATIONAL JOURNAL OF MODERN PHYSICS A 26(24), pp. 4153-4170, , 2011

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

- List up to 10 main presentations during FY2011 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	Shinji Mukohyama, Cosmology and GR limit of Horava-Lifshitz gravity, Xth International Conference on Gravitation, Astrophysics and Cosmology, 2011.12.21, Qui Nhon, Vietnam
2	Shigeki Matsumoto, The GeV-scale dark matter with B-L asymmetry, International Workshop on Neutrino Physics, Dark Matter and Gamma Rays, 2011.11.04-06, Taiwan
3	Toshiyuki Kobayashi, Analysis on pseudo-Riemannian locally symmetric spaces, Chern Centennial Conference, 2011.10.30-11.05, Berkeley, California, USA
4	Alexey Bondal, Orthogonal decomposition of $sl(n)$ and mutually unbiased bases, Derived Categories in Algebraic Geometry, 2011.09.05, Moscow, Russia
5	Taizan Watari, Studying GPD in Holographic QCD, String Phenomenology 2011, 2011.08.22-26, Madison, Wisconsin, USA
6	Todor Milanov, W-constraints for Frobenius manifolds, 4th International Conference in Integrable Systems and Mathematical Physics, 2011.07.25-29, Wuhan, China
7	Tadashi Takayanagi, Holographic Entanglement Entropy and its New Developments, Strings 2011, 2011.06.27-07.01, Uppsala, Sweden
8	Keiichi Maeda, Asymmetric SN Ia Explosions and Their Observational Diversities, Supernovae and Their Host Galaxies, 2011.06.20-24, Sydney, Australia
9	Shigeki Sugimoto, QCD and String Theory, 11 th Workshop on Non-Perturbative Quantum Chromodynamics, 2011.06.06-10, Paris
10	Hiroshi Ooguri, Spatially Modulated Phases, American Physical Society Meeting, 2011.04.30, Anaheim, California

C. Major Awards

- List up to 10 main awards received during FY2011 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	Takaaki Kajita, Japan Academy Award, March 2012
2	Masataka Fukigita, Yoji Totsuka Memorial Prize, March 2012
3	Tsutomu Yanagida, Yoji Totsuka Memorial Prize, March 2012
4	Masaomi Tanaka, Inoue Research Award for Young Scientists, February 2012
5	Brice Ménard, Sloan Research Fellowship, February 2012
6	Masahiro Ibe, Young Scientist Award in Theoretical Particle Physics, January 2012
7	Kyoji Saito, Mathematical Society of Japan Geometry Prize, September 2011
8	Tomoyuki Abe, Mathematical Society of Japan Takebe Prize, September 2011
9	Shigeki Sugimoto, JPS Award for Academic Papers on Physics, April 2011
10	

FY 2011 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 initial plan or the latest report, attach "Biographical Sketch of a New Principal Investigator".

<Results at the end of FY2011>

Principal Investigators Total:19

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 <u>Hitoshi Murayama</u> (48) (*)	IPMU (Director), University of California, Berkeley (Professor, Physics Dept)	Ph.D. particle theory, cosmology	45%	40%	0%	15%	10/1/2007	Stays 70% at IPMU, and 30% at UC Berkeley of which a half of the time at 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 (62) (*)	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 one a week	
Hiroaki Aihara (56) (*)	IPMU (Deputy Director), University of Tokyo (Professor, Physics Dept)	Ph.D. high energy physics	70%	5%	0%	25%	10/1/2007	Stays at IPMU once a week. Joins videoconference once a week.	
<u>Alexey Bondal</u> (50) (*)	Steklov Mathematical Institute (Professor) IPMU (Professor, joint appointment)	Ph.D. mathematics	40%	0%	40%	20%	10/1/2007	Stays at IPMU 6 month a year. Joins videoconference once a week.	Sending 1 senior scientist (2 weeks).

Masataka Fukugita (64) (*)	University of Tokyo (Professor, ICRR)	Ph.D. cosmology	70%	0%	30%	0%	10/1/2007	Usually stays at ICRR which is right next to IPMU.	
Kunio Inoue (46) (*)	Tohoku University (Professor, RCNS)	Ph.D. astroparticle physics	45%	0%	5%	50%	10/1/2007	Stays at Kamioka Branch once a week.	
Takaaki Kajita (53) (*)	University of Tokyo (Director, Professor, ICRR)	Ph.D. astroparticle physics	40%	0%	0%	60%	10/1/2007	Stays at Kamioka Branch once a week. Usually stays at ICRR which is right next to IPMU.	
<u>Stavros Katsanevas</u> (58) (*)	University of Paris 7 (Professor, Physics Dept)	Ph.D. astroparticle physics	20%	0%	10%	70%	10/1/2007	Stays at IPMU once a year. Joins videoconference once a month.	Sending 1 young scientist to IPMU (3 weeks).
Toshiyuki Kobayashi (49) (*)	University of Tokyo (Professor, School of Mathematical Sciences)	Ph.D. mathematics	70%	0%	8%	22%	6/1/2011	Stays at IPMU once a week. Joins videoconference once a week.	
Toshitake Kohno (56) (*)	University of Tokyo (Professor, School of Mathematical Sciences)	Ph.D. mathematics	70%	0%	8%	22%	10/1/2007	Stays at IPMU once a week. Joins videoconference once a week.	
Masayuki Nakahata (52) (*)	University of Tokyo (Professor, ICRR)	Ph.D. astroparticle physics	85%	0%	9%	6%	10/1/2007	Usually stays at Kamioka Branch.	

Mihoko Nojiri (49) (*)	KEK (Professor)	Ph.D. particle theory	40%	0%	40%	20%	10/1/2007	Stays at IPMU twice a week.	
Ken'ichi Nomoto (65) (*)	IPMU (Professor)	Ph.D. cosmology	70%	0%	12%	18%	10/1/2007	Stays at IPMU full time.	
<u>Hiroshi Ooguri</u> (50) (*)	California Institute of Technology (Professor, Physics Dept and Mathematics Dept) IPMU (Professor, joint appointment)	Ph.D. string theory	66%	0%	3%	31%	10/1/2007	Stays at IPMU 3 months a year. Joins videoconference once a week.	Sending 1 young scientist (2 weeks). Accepting 2 young scientists (2 weeks each).
Kyoji Saito (67) (*)	IPMU (Professor)	Ph.D. mathematics	80%	20%	0%	0%	10/1/2007	Stays at IPMU full time.	
<u>David Spergel</u> (51) (*)	Princeton University (Professor, Astronomical Sciences Dept)	Ph.D. cosmology	55%	0%	5%	40%	10/1/2007	Stays at IPMU once a year. Joins videoconference once a week.	Sending 1 professor (1 month), 4 young scientists (2 weeks each).
<u>Henry Sobel</u> (68) (*)	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 (3 weeks each).
Naoshi Sugiyama (50) (*)	Nagoya University (Professor, Physics Dept)	Ph.D. cosmology	47%	0%	3%	50%	10/1/2007	Stays at IPMU once a month. Joins videoconference once a week.	

Tsutomu Yanagida (63) (*)	IPMU (Professor)	Ph.D. particle theory	90%	0%	0%	10%	10/1/2007	Stays at IPMU full time.	
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Researchers unable to participate in project in FY 2011

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

Records of FY2011 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 [00 month, 00 year].

	Goal set in the "Post-interim evaluation revised center project"	Results at end of FY 2011	Final goal (Date: March, 2017)
Researchers	213 < 83, 39%> [5, 2%]	209 < 79, 38%> [5, 2%]	213 < 83, 39%> [5, 2%]
Principal investigators	22 < 8, 36%> [1, 5%]	19 < 4, 21%> [1, 5%]	22 < 8, 36%> [1, 5%]
Other researchers	191 < 75, 39%> [4, 2%]	190 < 75, 39%> [3, 2%]	191 < 75, 39%> [4, 2%]
Research support staffs	28	28	28
Administrative staffs	10	10 (3, 33%)	10 (3, 33%)
Total	251	247	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.

For the two original PIs in mathematics who had left IPMU, we replaced with A. Bondal in 2009 and T. Kobayashi in 2011. For another PI in cosmology, Katsuhiko Sato, who had left IPMU to become the president of National Institute for Natural Sciences, we are actively looking for a replacement.

- 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 with the best research environment so that they can make outstanding accomplishment during their 3 years terms at IPMU and become strong candidates for either faculty position or another post-doctoral position at prestigious places.

By the end of FY 2011 we had hired 61 postdocs and 34 left IPMU, some before the 3 year term. We have been able to recruit from a wide variety of places in the world and many have been from the top places such as Harvard, Princeton, MIT, and Chicago in US, University College London, Amsterdam, Ludwig-Maximilians, and ETH in Europe, and top places in other regions such as Seoul National U, U of Chile, U of Sao Paulo, and TIFR. Out of the 34 left IPMU, 14 found faculty positions (McGill, Arizona State, Iowa State, Chonnam National, Zhejiang, Hong Kong, Yokohama National, Kobe, Kyushu, Tohoku, NAOJ, and others). The 17 took another appointment as postdoc at prestigious places such as CERN, Max-Planck Inst.

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
Institute des Hautes Etudes 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 FY2011:

Total: 1411M yen

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

420M 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).

28.9M yen for JSPS's Institutional Program for Young Researcher Overseas Visits (starting from March 1, 2022).

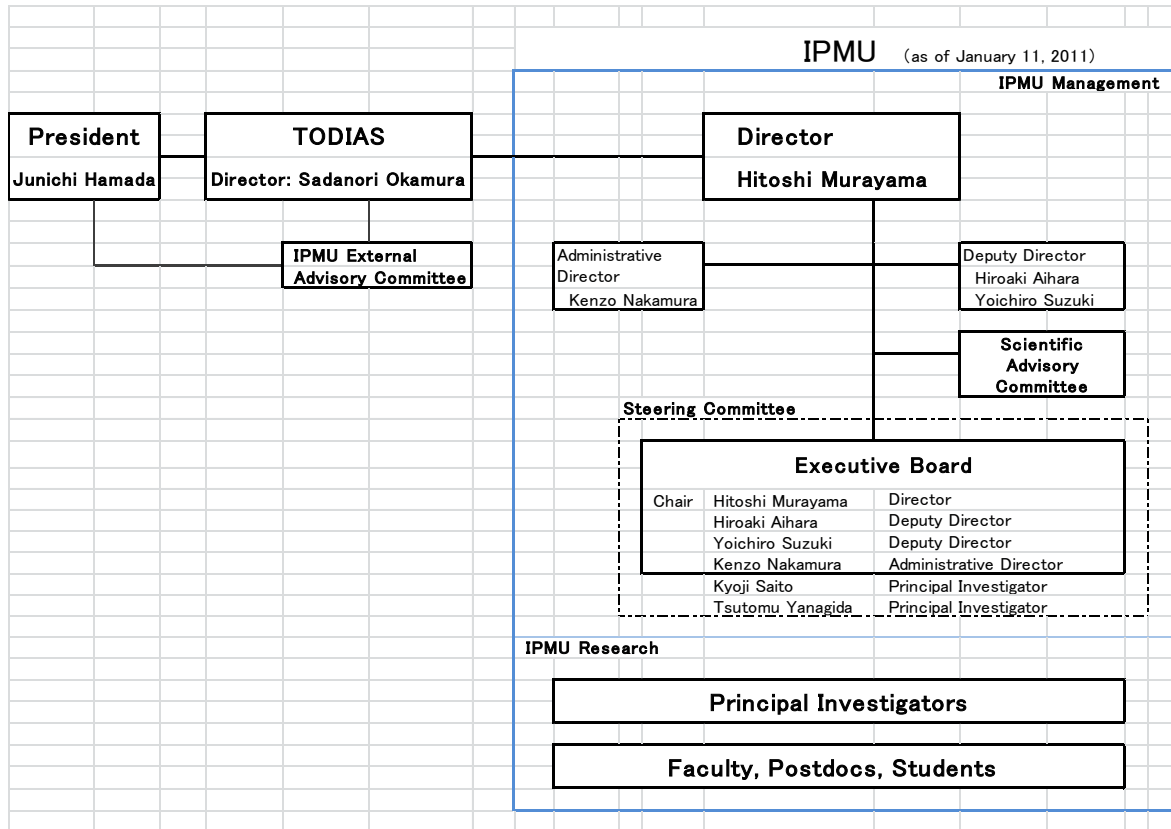
3. International research conferences or symposiums held to bring world's leading researchers together

- Indicate the number of international research conferences or symposiums held in FY2011 and give up to three examples of the most representative ones using the table below.

FY 2011: 12 meetings	
Major examples (meeting title and place held)	Number of participants
Curves and Categories in Geometry and Physics, IPMU	From domestic institutions: 33 From overseas institutions: 15
Testing Gravity with Astrophysical and Cosmological Observations, IPMU	From domestic institutions: 16 From overseas institutions: 22
IAU Symposium 279: Death of Massive Stars: Supernovae and Gamma-ray Bursts, Nikko	From domestic institutions: 59 From overseas institutions: 100

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)

6. FY2011 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	43
	Principal investigators (no. of persons):10	120
	Other researchers (no. of persons):108	857
	Research support staffs (no. of persons):26	121
	Administrative staffs (no. of persons):10	93
	Total	1,234
Project activities	Gratuities and honoraria paid to invited principal investigators (no. of persons):21	29
	Cost of dispatching scientists (no. of persons):1	3
	Research startup cost (no. of persons):58	34
	Cost of satellite organizations (no. of satellite organizations):1	0
	Cost of international symposiums (no. of symposiums):12	5
	Rental fees for facilities	279
	Cost of consumables	139
	Cost of utilities	20
	Other costs	100
	Total	609
Travel	Domestic travel costs	17
	Overseas travel costs	45
	Travel and accommodations cost for invited scientists (no. of domestic scientists):64 (no. of overseas scientists):191	43
	Travel cost for scientists on secondment (no. of domestic scientists):0 (no. of overseas scientists):18	9
	Total	114
	Equipment	Depreciation of buildings
Depreciation of equipment		382
Total		531
Other research projects	Projects supported by other government subsidies, etc.	470
	Commissioned research projects, etc.	13
	Grants-in-Aid for Scientific Research, etc.	574
	Total	1,057
Total		3,545

Ten thousand dollars

WPI grant		1,693
Costs of establishing and maintaining facilities		1,250
IFIMU ANNEX LABORATORY (Number of facilities: 3,000m ²)	Costs	1,250
Cost of equipment procured		56
Clean Room		
Number of units:1set	Costs paid:	10
3D Printer		
Number of units: 1set	Costs paid:	5
Others		41

ii) Costs of Satellites and Partner institutions

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

Status of Collaboration with Overseas Satellites

1. Coauthored Papers

- List the refereed papers published in FY2011 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 IPMU Berkeley Satellite (Total: 3 papers)

No.	Author names and details
1-18	Search for extraterrestrial antineutrino sources with the KamLAND detector, <i>Brian Fujikawa, Stuart Freedman</i> and KamLAND collaboration, Astrophysical Journal 745, 193, Feb 1, 2012.
1-129	Measurement of the B8 solar neutrino flux with the KamLAND liquid scintillator detector, <i>Brian Fujikawa, Stuart Freedman</i> and KamLAND collaboration, Physical Review C 84, 035804, Sept 13, 2011
1-148	Partial radiogenic heat model for earth revealed by geoneutrino measurements, <i>Brian Fujikawa, Stuart Freedman</i> and KamLAND collaboration, Nature Geoscience 4, 647, Sept 2011.

Overseas Satellite 2 (Total: 00 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 FY2011. 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: IPMU Berkeley Satellite

<To satellite>

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2011	0 1	0 4	0 0	0 0	0 5
Total	0 1	0 4	0 0	0 0	0 5

<From satellite>

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2011	0 1	0 3	0 1	0 0	0 5
Total	0 1	0 3	0 1	0 0	0 5

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
FY2011					
Total					

<From satellite>

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2011					
Total					

FY 2011 Visit Records of World Top-caliber Researchers from Abroad

Researchers Total: 23

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)
Jerome Freedman (83)	Professor, Department of Physics, MIT	Ph.D. High Energy Physics	Nobel Prize in Physics 1990	2011/10/5- 2011/10/7	Public lecture
Edwin Turner (63)	Professor, Department of Astrophysical Sciences, Princeton U	Ph.D. Astrophysics	National Merit Scholar NSF Graduate Fellow Alfred P. Sloan Research Fellow	2011/5/26- 2011/6/30 2011/10/14 -2011/11/2 2012/1/18 -2012/2/4	Joint Research as Scientific Associate and Visiting Senior Scientist
Alexander Kusenko (46)	Professor, Department of Physics and Astronomy, UCLA	Ph.D. Particle Theory	American Physical Society APS Fellow (since 2008) American Physical Society Outstanding Referee Award (2012)	2011/5/29 -2011/6/4 2011/10/4 -2011/12/1	Organizing the Focus Week Joint research as Scientific Associate and Visiting Senior Scientist
David Spergel (51)	Chair, Charles A. Young Professor, Department of Astrophysical Sciences, Princeton U	Ph.D. Cosmology	Shaw Prize 2010	2011/6/4 -2011/6/18 2012/1/8 -2012/1/14	Joint Research as Scientific Associate Giving a public lecture
Paul Ho(61)	Director, ASIAA Senior Astrophysicist, Smithsonian Astrophysical Observatory	Ph.D. Astronomy	Fellow, Academy of Sciences for the Developing World, 2010	2011/7/10 -2011/7/14 2012/1/7 -2012/1/10	Attendance at the PFS collaboration Meeting
James Gunn (73)	Eugene Higgins Professor, Department of Astrophysical Sciences, Princeton U	Ph.D. Astrophysics	National Medal of Science , 2009 Gruber Prize in Cosmology, 2005	2011/7/10 -2011/7/13 2011/11/21 -2011/12/15 2012/1/7 -2012/1/14	Attendance at the PFS collaboration Meeting Joint Research

Richard Ellis (62)	Steele Professor, Department of Astronomy, CALTECH	Ph.D. Astronomy	Gold Medal, Royal Astronomical Society, 2011 Royal Astronomical Society Group Award, 2008	2011/7/11 -2011/7/13 2011/10/2 -2011/10/8 2012/1/8 -2012/1/11	Attendance at the PFS collaboration Meeting Giving a public lecture Joint Research
David R. Morrison (56)	Professor, Mathematics and Physics departments, UC Santa Barbara	Ph.D. Mathematics	Mathematical Sciences Research Institute Research Professorship, 2006	2011/7/24 -2011/7/27	Participation in External Advisory Committee
John Ellis (65)	Physicist, CERN	Ph.D. Particle Theory	Paul Dirac Medal and Prize, 2005	2011/7/24 -2011/7/27	Participation in External Advisory Committee
Roberto Peccei (70)	Professor, Physics Department, UCLA	Ph.D. Particle Theory	Fellow, World Academy of Arts and Sciences 2008-	2011/7/25 -2011/7/27	Participation in External Advisory Committee
Steven Kahn (57)	Cassius Lamb Kirk Professor, Physics Department, Stanford U and SLAC	Ph.D. Cosmology	American Physical Society Fellow since 1991, Deputy Project Director and Camera Lead Scientist, Large Synoptic Survey Telescope Project, 2004 -	2011/7/25 -2011/7/27	Participation in External Advisory Committee
Bryan Webber (68)	Emeritus Professor of Theoretical Physics, U Cambridge	Ph.D. Particle Theory	Maxwell Medal and Prize 1982 Paul Dirac Medal and Prize 2008	2011/9/3 -2011/9/30	Joint Research Organizing the summer school
Serguey Petcov (61)	Professor, High Energy Physics sector, SISSA	Ph.D. Particle Theory	Bruno Pontecorvo Prize 2010	2011/9/8 -2011/9/24	Joint Research as Scientific Associate and Visiting Senior Scientist

Michael Strauss (50)	Professor, Dept. Astrophysical Sciences, Princeton U	Ph.D. Astronomy	Newton Lacy Pierce Prize (American Astronomical Society) 1996 Mary Elizabeth Uhl award (Astronomy Dept. UCB) 1988	2011/9/24 -2011/10/3 2012/1/7 -2012/1/14	Attendance at the PFS collaboration Meeting Joint Research
Bumsig Kim(44)	Professor, School of Mathematics, KIAS	Ph.D. Mathematics	KMS Research Award	2011/10/30 -2011/11/5	Attendance at Workshop
Ludmil Katzarkov (50)	Professor, department of mathematics, UC Irvine and Universität Wien, Austria	Ph.D. Mathematics	ERC Advanced Grant 2008	2011/11/2 -2011/11/7	Attendance at Workshop
Charles L. Bennett (55)	Alumni Centennial Professor, Dept. Physics and Astronomy, Johns Hopkins U.	Ph.D. Astronomy	Johns Hopkins Gilman Scholar, Shaw Prize 2010 Comstock Prize in Physics 2009	2012/1/6 -2012/1/12	Attendance at the PFS collaboration Meeting
Henry Tye (64)	Horace White Professor, Dept of Physics, Cornell U	Ph.D. Particle Theory	Fellow, American Physical Society	2012/1/9 -2012/1/15	Giving lectures at Winter School in Kusatsu
Alexander Dolgov (70)	Professor, Department of Physics, University of Ferrara	Ph.D. Astrophysics	Landau-Weizmann Award for theoretical physics, by the Weizmann Institute 1996,	2012/1/13 -2012/2/12	Joint Research Giving a seminar
Ashoke Sen (55)	Professor, Harish-Chandra Res. Inst.	Ph.D. String Theory	Third World Academy of Sciences Prize 1997 Pius IX Gold Medal 2006	2012/1/15 -2012/1/20	Giving lectures at Winter School in Kusatsu
Alexander Voronov (49)	Professor, School of Mathematics, U Minnesota	Ph.D. Mathematics	Simons Fellow in Mathematics 2012	2012/1/19 -2012/3/3	Joint Research as a Visiting Senior Scientist
Sergei Blinnikov (63)	Head Scientist, Laboratory for Astrophysics and Thermonuclear Fusion, ITEP	Ph.D. Astronomy	Services Prize by Nuclear Energy & Sci-Techn Ministries 2005	2012/1/29 -2012/2/11	Giving a seminar Joint Research
Martin Elvis (61)	Professor, Harvard U, Senior Astrophysicist, Smithsonian Astrophysical Observatory	Ph.D. Astrophysics	Pirelli International Prize 2007 Multimedia Science Communication Prize 2006	2012/2/11 -2012/2/23	Attendance at COSMOS meeting

State of Outreach Activities

- Using the table below, show the achievements of the Center's outreach activities in FY2011 (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 FY2011 resulting from press releases and reporting.

Activities	FY2011(number of activities, times held)
PR brochure, pamphlet	6
Lectures, seminars for general public	11
Teaching, experiments, training for elementary and secondary school students	8
Science cafe	4
Open houses	1
Participating, exhibiting in events	2
Press releases	25

Special Achievements

Program for future scientists

-
- Science camp for high school students held jointly with JST, "Physics and mathematics for exploring the universe" 2011: Dec 26–28
 - A part of UT Science Faculty project, held jointly with JST, a special event for motivating the scientific mind of female junior high school and high school students 2011:Nov 23

Exhibitions aiming at policy makers as well as general public

-
- Kagakugijutsu-Festa in Kyoto 2011:Dec17-18
 - AAAS annual meeting in Vancouver, Canada 2012:Feb17-19

Social Networking Services for general public

Blog

- IPMU semi-official blog: <http://ipmu.exblog.jp> (Press Officer/2008 Jul-)
- Hiroshi Ooguri: <http://planck.exblog.jp/> (Prof. Hiroshi Ooguri/2009 Jan-)

Twitter

- Twitter (account: IPMULife) <http://twitter.com/#!/IPMULife> (2011.May -)

Books for general readers

-
- "One and only one universe?" (Hitoshi Murayama, 2011 Jul, Shueisha Bluebacks)
 - "How the first star was born in the Universe" (Naoki Yoshida, 2011 Oct, Takarajima-sha)
 - "Miracle of beautiful universe" (Hitoshi Murayama, 2012 Shueisha International)

FY 2011 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	2012/2/21	The Sankei Shimbun (West Japan Edition)	Advancing Space observations - extraterrestrial life exist?
2	2012/2/12	Galileo X/ BS Fuji Television	Supernova explosion - the origin of elements
3	2012/2/9	The Asahi Shimbun, The Yomiuri Shimbun The Manichi Newspaper The Sankei Shimbun The Nikkei Shimbun The Nikkan Kogyo Shimbun	< PRESS RELEASE > NEW KAVLI INSTITUTE ANNOUNCED AT THE UNIVERSITY OF TOKYO Institute for the Physics and Mathematics of the Universe Receives Major Endowment from The Kavli Foundation and Joins Family of Kavli Institutes.
4	2012/2/9	Bakumon Gakumon/ NHK Television	Take us to the edge of the Universe! * Interviewing with Director Murayama
5	2012/2/6	The Nikkei Shimbun	< PRESS RELEASE > Precise measurement of dark matter distribution with strong and weak gravitational lensing
6	2012/1/12	Science Asahi/BS Asahi Newstar Television	Particle physics experiments draw attention * Interviewing with Director Murayama.
7	2012/1/5	The Sankei Shimbun	Prof. Nomoto talks about Betelgeuse
8	2011/11/26	Science Zero/ NHK Television	Red supergiant star, Betelgeuse, is about to blow?
9	2011/11/11	Good morning Japan/NHK Television The Sankei Shimbun Nikkei Science	< PRESS RELEASE > The first star weighed 40 times the sun
10	2011/10/31	The Asahi Shimbun	At the end of expanding the universe? -The Big Rip in the 100 billion years?

11	2011/10/25	JJI Press, The Nikkei and other news websites.	< PRESS RELEASE > Galaxy interactions accelerate the growth of supermassive black hole
12	2011/10/9	Miracles in the Earth/TV Asahi	Genius in Japan - Addressing deep mystery of the Universe * Introducing IPMU and its research activities.
13	2011/November issue	Nikkei Science	Japanese wisdom that change the world- Close to the Nobel Prize *Director Murayama, Prof. Suzuki, Prof. Kajita are addressed.
14	2011/September issue	Newton	Special report- Birth of the Universe and its future
15	2011/7/2 issue	Weekly Toyo-Keizai	Gathering the best brains from the world- Introducing a cutting edge research center at U Tokyo
16	2011/6/28	Cosmic Front / NHK Television	About explode? -Red giant star, Betelgeuse-
17	2011/6/26	Galileo X/ BS Fuji Television	Mystery of Dark matter-Distributed across the Universe
18	2011/5/21	The Asahi Shimbun	Front Runner - Director Murayama, speaking out from a cutting edge research center addressing the mystery of the Universe
19	2011/5/18	TV Symposium/ NHK Educational Television	FIRST Science Forum -Break down the common senses to become the World's top research project
20	2011/4/19	Cosmic Front / NHK Television	Challenges the mystery of Dark matter