

# World Premier International Research Center Initiative (WPI) FY2014 WPI Project Progress Report (Post-Interim Evaluation)

Host Institution	Tohoku University	Host Institution Head	Susumu Satomi
Research Center	Advanced Institute for Materials Research (AIMR)	Center Director	Motoko Kotani

Common instructions:

- \* Unless otherwise specified, prepare this report from the timeline of 31 March 2015.
- \* 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)

In FY2014, AIMR concentrated on implementing mathematics–materials science (math-mate) collaboration and reinforcing the global research network, and achieved some remarkable results. With regard to the **math-mate collaboration**, under the leadership of the Center Director (mathematician) and Administrative Director (theoretical physicist), we took up some challenging themes and obtained concrete results which will lead to "creation of new materials science." Although it was only three years ago when we initiated the new approach, some excellent papers have been published as a result of collaboration between mathematicians and materials scientists. In regard to the **global research network**, AIMR established a joint laboratory (Joint Research Center) at the University of Chicago and gained a foothold in promoting "**spin-centered materials science**" in the world. Some instances of organizational reform established at AIMR, for example, provision of administrative services in English, were put in the measures of the host institution, Tohoku University. In July 2014, Tohoku University established the "**Organization for Advanced Studies (OAS)**" and AIMR became the first institute involved in this organization. The Administrative Division of AIMR will be shifted to the international administrative office of OAS, and will lead the internationalization of Tohoku University. The support for researchers (e.g. by Research Support Center) has also been widened and AIMR has reached maturity as a unique international institute for materials science.

### **"Conducting research of the highest world level"**

The researchers of AIMR have produced research results with the highest quality and impact over the past seven years, from basic research to application. In 2014 (from January to December), AIMR researchers published 380 papers in high-impact journals including *Science* and *Nature's* sister journals. AIMR's full-time researchers gave more than 120 invited presentations at international meetings, and received high level international and domestic scientific awards in FY2014 (from April 2014 to March 2015). Furthermore, AIMR researchers obtained 2.8 billion yen in total in FY2014 as external research funds, including two ERATO projects. All these outcomes indicate the visible activity of AIMR researchers in the global research stage.

### **"Advancing fusion of various research fields"**

In FY2014, AIMR concentrated on **math-mate collaboration**, and went on with four target projects in which important challenges to both materials science and mathematics were identified, and concrete results were obtained which will lead to the "creation of new materials science." Some excellent papers have been published as a result of collaboration between mathematicians and materials scientists.

### **“Globalization of the Institution”**

In FY2014, AIMR kept the ratio of researchers from abroad to the total number of researchers around 50% (47% as of March 31, 2015). With respect to the **global research network**, we strengthened our cooperation with five overseas institutions including the University of Cambridge, the University of California, Santa Barbara, Institute of Chemistry, the Chinese Academy of Science (jointly with Tsinghua University), the Chemnitz University of Technology (Fraunhofer ENAS), and the University of Chicago. AIMR established a joint laboratory (AIMR Joint Research Center) in the University of Chicago in FY2014. At Chicago, progress in international collaboration on **“spin-centered materials science,”** which is one of the AIMR’s challenges, is expected. The AIMR International Symposium (AMIS2015) held in February 2015 gathered 268 participants from 14 countries. Furthermore, programs for promoting international exchange, such as GI<sup>3</sup> (Global Intellectual Incubation and Integration) Laboratory Program and Global Brain Circulation Program, worked well and propelled global brain circulation.

### **“Implementing organizational reforms”**

In FY2014, some instances of **organizational reform** established at AIMR such as “an administrative system providing services in English” and “a joint appointment system,” were put in the measures of the host institution, Tohoku University. These measures for the entire university were stipulated in “Tohoku University Global Vision” known to the public in May 2014 as well as “SATOMI VISION” announced in 2013. In July 2014, Tohoku University established the **“Organization for Advanced Studies (OAS)”** modeled upon AIMR’s internationalization and organizational reform. AIMR has been put in OAS as the first institute and will lead the construction of international research environment at Tohoku University. The Administrative Division of AIMR will remain as the international administrative office of OAS, and continue to play a central role in the internationalization of Tohoku University. The support for researchers, for example, by Research Support Center (including Common Equipment Unit and Researcher Support Office) has also been widened and is propelling world-leading research.

### **“Efforts to secure the center’s future development over the mid- to long term”**

AIMR’s research objective is to promote ongoing math-mate collaboration and establish new materials science by which we can design new functional materials based on predictions. In the long-term, by utilizing new predictive materials science, we will contribute to society through creating revolutionary Green Materials. In order to accomplish this goal, AIMR is making maximum efforts to push math-mate collaboration and strengthen the global research network. President Satomi pledged to prepare a budget and create ten new tenure positions to maintain AIMR. Using the tenure positions, a full professor from Durham University (molecular electronic materials) moved to AIMR with his research team, and a Junior PI in spintronics was promoted to become a tenured PI. AIMR will continue employing talented researchers and promote excellent young researchers to PI (professor) or Junior PI (associate professor). AIMR has become the first OAS institute established in FY2014, and AIMR has started to apply proposals for the internal and external funds. AIMR’s Administrative Division will be shifted to the administrative office of OAS and will play a central role of internationalization and organizational reform for Tohoku University. AIMR will further strengthen partnership with industry not only to increase research funds but also to apply AIMR’s new materials science and materials to new devices and systems which contribute to society. Based on these factors, it is expected that sufficient resources will be secured to maintain AIMR and AIMR’s research activity.

- 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 pages (excluding the appendices, and including Summary of State of WPI Center Project Progress (within two pages)).

## 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.

AIMR researchers are constantly producing research results of the highest quality and impact in the materials science field (**Appendix 1**) under the excellent leadership of 30 principal investigators (PIs) (**Appendix 2, 3-1**). In 2014 (from January to December), AIMR researchers published **380 papers** (**Appendix 1-A**), the highest number ever, while AIMR has published more than 300 papers every year. Thirteen papers of them appeared in *Science*, *Nature’s* sister journals and *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*; and other papers were also published in the highest-ranked journals in the field of materials science, physics, applied physics, chemistry, nano science, and device engineering, such as *Advanced Materials*, *Physical Review Letters (PRL)*, *Applied Physics Letters (APL)*, *Journal of the American Chemical Society (JACS)*, *Nano Letters*, and *Lab on a Chip*. In FY2014 (from April 2014 to March 2015), AIMR’s full-time researchers gave more than 120 invited presentations at international meetings (**Appendix 1-B**) and received high level international and domestic scientific awards including *Royal Society Wolfson Research Merit Award* (Prassides PI), *Materials Today Conference Award* (Chen PI), *the American Institute of Chemical Engineers (AIChE) Nanoscale Science and Engineering Forum (NSEF) Young Investigator Award* (Khademhosseini PI), *Science of Hydrogen & Energy Award* (Orimo PI), *IEEE Andrew S. Grove Award* (Esashi PI), and *the Honda frontier prize* (Takahashi PI). Furthermore, in 2014 AIMR researchers were elected as a member of the American Academy of Arts and Sciences (Weiss PI), as an Academician of World Academy of Ceramics (Ikuhara PI), and as Thomson Reuters Highly Cited Researchers 2014 (Chen PI, Takahashi PI and Khademhosseini PI) (**Appendix 1-C**). Such researchers of the highest level give good influence to each other and AIMR researchers obtained 2.8 billion yen in FY2014 (**Appendix 3-2**) and this corresponds to **6.5%** of the entire external research funds of Tohoku University. All these outcomes indicate the visible activity of AIMR researchers on the global research stage. Furthermore, subsequently to the ERATO Isobe Degenerate  $n$ -Integration Project started in FY2013, ERATO SAITOH Spin Quantum Rectification started in FY2014.

In the past few years, AIMR has focused on the development of “**spin-centered materials science**” and “**mathematics-materials science (math-mate) collaboration**” though, of course, these two themes are closely related with each other. In **spin-centered materials science**, some new phenomena were discovered, for example, in one-dimensional edge states with giant spin splitting (A. Takayama, T. Takahashi et al., *Phys. Rev. Lett.* **114**, 066402 (February 2015)) and in perpendicular magnetic anisotropy (Q. L. Ma, S. Mizukami, et al., *Phys. Rev. Lett.* **112**, 157202 (2014)). The start of ERATO SAITOH Spin Quantum Rectification will further accelerate the spin-centered materials science at

AIMR. In **math-mate collaboration**, we identified important challenges to both materials science and to mathematics based on intensive discussion and preliminary research along the three target projects in FY2012-2013. In FY2014, we obtained some emerging results. Some of them have already been published as papers, for example, the papers written by Prof. Isobe's group (organic chemistry) and Prof. Kotani's group (mathematics) which will be described in detail in the next section "2. Advancing fusion of various research fields."

After the Nobel Prize in Physics was awarded to Andre Geim and Konstantin Novoselov for their "groundbreaking experiments regarding the two-dimensional material graphene" in 2010, **graphene** has become one of the hottest materials in materials science, physics, and chemistry, and a huge number of researchers have joined this field. As mentioned above, "synthesis for new carbon materials" is one of our challenges identified for math-mate collaboration, and **graphene** is a good target material compatible with this challenge. In FY2014, excellent results of synthesizing "new graphene structures" were achieved at AIMR and we briefly explained the following two results:

**Three-dimensional (3D) nanoporous graphene:** A research group consisting of AIMR researchers from materials science, physics, and chemistry, succeeded in synthesizing a novel material made up of carbon atoms, "3D nanoporous graphene." They used nanoporous metal, which has been studied intensively at AIMR for the past several years, as a mold for nanoporous graphene formation. Graphene was deposited on the mold of nanoporous metal using the chemical vapor deposition (CVD) method. This recipe enabled them to obtain 3D structures made of two-dimensional (2D) graphene. The synthesized 3D nanoporous graphene showed an electron mobility of  $500 \text{ cm}^2/\text{Vs}$ , which is high enough for practical transistors. Results of magnetoresistance/electrical conductance and photoemission spectroscopy measurements suggested an existence of 2D mass-less Dirac cone electronic structure in 3D nanoporous graphene. Previous 3D carbon materials were amorphous and discontinuous (mainly powder), and they showed several orders of magnitude lower electric conductivity than crystalline graphene. The nanoporous graphene made in this study is constructed by a single layer graphene sheet with excellent crystallinity. It is greatly expected that this nanoporous graphene will result in a new device which can be replaced with Si devices. These researchers also studied the influence of nitrogen doping on catalytic response toward the oxygen reduction reaction, as well as the influence of nitrogen and sulfur doping on catalytic activities for the hydrogen evolution reaction, and obtained good results leading to the application to practical devices such as fuel cells (Y. Ito, M.W. Chen et al., *Angewandte Chemie International Edition* **53** (2014) 4822-4826; *Advanced Materials* **26** (2014) 4145-4150; *Angewandte Chemie International Edition* **54** (February 2015) 2131-2136).

**Control of graphene-edge configuration by molecular self-assembly:** Precise graphene nanoribbons (GNRs) with periodic regions of zigzag-edges were produced using a novel bottom-up fabrication method by the research team of surface scientists and synthetic chemists from AIMR. Graphene is composed of a single-atomic layer of carbon atoms in a honey-comb lattice. One ongoing strategy focuses on using graphene edge conformations as a means to control the electronic and magnetic properties. However, neither lithography (top-down), nor molecular-assemblies (bottom-up) have produced GNRs with defect-free zigzag edges to date. In this study, the team deposited a precursor molecule, known to form armchair-GNR, onto a Cu substrate. Utilizing properties specific to this substrate, they changed the assembly chemistry to produce GNRs with periodic zigzag features instead. They carried out this series of experiments using a scanning tunneling microscope (STM) they developed with the world's highest resolution. This fabrication method, which also controls GNR growth direction and

length distribution, may be a stepping stone towards future graphene-device fabrication by self-assembly (P. Han, K. Akagi, P.S. Weiss, N. Asao, T. Hitosugi et al., *ACS Nano* **8** (2014) 9181–9187).

## 2. Advancing fusion of various research fields

In FY2014, we continued the “Fusion Research Proposal Program” to help researchers start interdisciplinary fusion research with research groups of different fields. Of course, research proposals with mathematicians (or Interface Unit theoretical researchers) were encouraged. The Interface Unit consists of young theoretical researchers studying physics and chemistry. This Unit played an important role in helping bridge the gap between mathematicians and materials scientists, as well as encourage collaboration, and some excellent papers were published as a result. The research progress of each team were shared in daily seminars and at the Target Project–Interface Unit (TP–IU) Joint Forum. Thanks to those efforts, 48 papers were published from AIMR as the result of fusion research between two or more laboratories of different fields.

Based on the many examples of excellent results resulting from fusion research, two specific results based on fusion research with strong mathematical components are shown below.

**3D network structure inside of nanoporous gold:** In this study, a fusion research team consisting of a theoretical chemist, a metallurgist, and synthetic chemists, investigated the 3D network structure of pores in nanoporous gold using **graph theory**, **probability theory**, and **random walks** (convergence rate of Markov chains), and extracted the factors influencing diffusion in the nanopore network. Nanoporous gold consists of metallic gold and a disordered network of pores. This material can be obtained by a process of selective dissolution (dealloying) of silver from gold-silver alloy. They used a 3D image of this material, which was obtained using transmission electron microscope (TEM) tomography. They skeletonized pore parts in the 3D image using a thinning algorithm, and extracted the **graph** of the nanoporous network. Even though the graph is a highly simplified representation of the actual porous structure, it is still very complicated and difficult to describe. In order to describe the graph in a compact way, they divided the graph into **subgraphs** and classified them. It turned out that the graph could be constructed from a large number of relatively simple types of small subgraphs. **Random walks** on these subgraphs were then studied. Molecular **diffusion** inside of the nanopores can be modeled using the random walk. The speed of the diffusion can be measured by the “mixing time,” which measures how quickly the probability distribution of the random walk converges to its equilibrium distribution. Their theoretical consideration provided a novel insight into how the “local” connectivity of pores inside of nanoporous gold affects the rate of diffusion of molecules through the global pore network (D.M. Packwood, T. Jin, T. Fujita, M.W. Chen and N. Asao, Mixing time of molecules inside of nanoporous gold. *SIAM Journal on Applied Mathematics* **74** (2014) 1298-1314).

**Geometrical investigation of curved carbon materials:** Carbon materials, because of their **geometrical** characteristics, have been among the most important research targets, both of mathematicians and materials scientists, such as synthetic chemists. Although there had been few direct interactions between them so far, it is highly expected that their collaboration will produce good results as we can see in the following two examples of research. In the first example, synthetic chemists investigated the development of new geometric measures for finite carbon nanotube (CNT) molecules with the help of a mathematician (geometer). A **chiral index** using the coordinates  $(n,m)$  were proposed for geometric

measures in 1992 and widely accepted. However, there has been no measure for finite CNT molecules because such molecules themselves have not existed so far. In recent years, the successful synthesis of finite carbon nanotubes with discrete sizes has been realized, and the need for an **index** to measure length and bond-filling and atom-filling rates has increased. In this study, the researchers succeeded in obtaining a new index for this purpose. It is expected that the newly proposed **geometric index** will be the basis for the development of science and technology related to finite CNT molecules. The second example is the study of carbon materials with **negative curvature**. The study was led by mathematicians, but also included contributions from materials scientists who helped with the first principles calculations. In 1991, Mackay and Terrones proposed a carbon crystal structure with negative curvature called the Mackay-Terrones crystal or Mackay crystal. Because surfaces with negative curvatures are mathematically more stable under local deformation, it would be promising to search for more “negatively curved” networks. They investigated the stable structures of carbon crystals with  $sp^2$ -bonding based on two key ideas (1) geometric descriptions based on curvatures, symmetries, etc. and (2) the standard realization of crystal lattices via harmonic theory to identify stable coordinates. They applied this method to negatively curved carbon crystals with **octahedral symmetry** which were proposed by Mackay and Terrones, and they were able to identify several new structures as a result. This outcome suggests that new carbon materials with novel structures and functions can be predictively designed based on mathematics (T. Matsuno, H. Naito, S. Hitosugi, S. Sato, M. Kotani and H. Isobe, Geometric measures of finite carbon nanotube molecules: a proposal for length index and filling indexes. *Pure and Applied Chemistry* **86** (2014) 489-495; M. Tagami, Y. Liang, H. Naito, Y. Kawazoe and M. Kotani, Negatively curved cubic carbon crystal with octahedral symmetry. *Carbon* **76** (2014) 266-274).

Generally speaking, exchange among different fields begins from “**interest**,” and moves toward the phases of “**interaction**” and “**inspire**,” and finally reaches “**integration**.” What is most important is that we progress step by step without skipping any steps. We have spent more than three years on these steps and have reached the “**integration**” phase. We have realized an environment in which mathematicians and materials scientists can talk with one another without any hesitation, and can collaborate and publish papers together in a comfortable and natural manner.

### 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)

In FY2014, AIMR maintained the ratio of researchers from abroad to the total number of researchers around 50% (47% as of March 31, 2015 as shown in **Appendix 3-1**). Furthermore, by utilizing the GI<sup>3</sup> (Global Intellectual Incubation and Integration) Laboratory Program, Global Brain Circulation Program, Overseas Dispatch Program for Young Researchers and some other programs, AIMR has promoted the exchange of researchers, and many researchers have stayed at AIMR and carried out joint research (**Appendix 5**).

In FY2014, AIMR further strengthened its cooperation with five overseas institutions, the University of

Cambridge, the University of California, Santa Barbara, Institute of Chemistry, the Chinese Academy of Science (jointly with Tsinghua University), the Chemnitz University of Technology (Fraunhofer ENAS), and the University of Chicago. AIMR signed an agreement with the University of Chicago to establish the UChicago/AIMR Joint Research Center in April 2014, and AIMR established a joint laboratory (Joint Research Center) in the University of Chicago. Before FY2014, we had set three joint laboratories at three satellite institutions at the University of Cambridge, the University of California, Santa Barbara, and Institute of Chemistry, the Chinese Academy of Science (jointly with Tsinghua University) (**Appendix 4**). Through collaboration at the Chicago joint laboratory, progress is expected to be made in "spin-centered materials science," which is one of AIMR's challenges.

AIMR held international research meetings as listed in **Appendix 3-3**. The AIMR International Symposium (AMIS2015) held in February 2015 gathered 268 participants from 14 countries. In addition, AIMR has frequently held joint workshops with overseas partner institutions including satellites. These activities largely contributed to AIMR's international recognition. Furthermore, AIMR plays a central role in Tohoku University's international events, such as Tohoku University Day (held in Cambridge, U.K. on December 9-10, 2014). Important international meetings which AIMR held in FY2014 are listed as follows:

- **Joint workshop with the University of Chicago:** The University of Chicago and AIMR signed an agreement to establish the UChicago/AIMR Joint Research Center in April 2014. Based on the agreement, AIMR held the 1<sup>st</sup> joint workshop with the Institute for Molecular Engineering (IME) of the University of Chicago on September 18-19 at AIMR. In this workshop, leading experts from a wide range of mathematics and materials science fields who utilize spin science, quantum computing, biological materials, chemical synthesis, surface chemistry, hydrogen functional materials, and computer simulation to understand and design new materials, got together to have a discussion from an interdisciplinary viewpoint to conduct joint research projects.
- **Four WPI centers joint participation in E-MRS:** AIMR and three WPI institutes (MANA, iCeMS, I<sup>2</sup>CNER) hosted an exhibit booth at the European Materials Research Society (E-MRS) 2014 Spring Meeting held in Lille, France on May 26-30, 2014. MANA was the main organizer of this joint participation in the E-MRS meeting among the three other centers who co-organized it. The workshop "Japan in Motion - Recent WPI advances in materials" was held on May 28. Both the WPI booth and workshop showed the latest advance of a range of research at the WPI centers and their efforts to create an open research environment.
- **Joint workshop with the University of Cambridge:** Tohoku University held Tohoku University Day at the University of Cambridge on December 9-10, 2014. On the second day (10th), AIMR held a joint workshop on materials science with the University of Cambridge. The workshop began with the opening remarks by Prof. Lindsay Greer and Prof. Motoko Kotani, and plenary talks were delivered by six professors including Taro Hitosugi, Yasumasa Nishiura, and Naoki Asao. More than 30 researchers joined this workshop and discussed the latest trends in metallurgy, spintronics, and topological insulators.

In addition, AIMR, held a joint workshop with National Chiao Tung University (NCTU) Joint Workshop on September 22-23, 2014 at the National Chiao-Tung University in Hsinchu. In particular, the the focus of the workshop was to promote interactions in device tchnology, which is NCTU's strong point.

From the viewpoint of brain circulation, the young researchers have obtained higher positions after their experience at AIMR for several years. Some of them have even become full professors at

universities (**Appendix 3-1**).

It goes without saying that strong support by the Administrative Division, of which 90% or more of staff members can provide service in English, is still kept so that researchers from abroad can concentrate on their research without any inconvenience. The skill of the administrative staff to carry out international work is refined by the Overseas Training Program for Administrative Staff. This program consists of two parts; one is to dispatch AIMR's administrative staff to overseas institutions to learn about administration and research support systems, and the other is, vice versa, to invite administrative staff from overseas institutions and create opportunities to work together at AIMR. In FY2014, three teams from AIMR's Administrative Division were dispatched to Europe and the United States of America (Team A Texas A&M University and the University of Chicago; Team B University of Copenhagen, Polish Academy of Science, ETH, and IBM Zurich Research Laboratory; Team C University of Massachusetts Amherst and Harvard University). Furthermore, AIMR invited administrative staff from the Carnegie Institution for Science in June and from the University of Copenhagen in March. Such invitations from overseas institutions provides learning opportunities not only for dispatched staff, but for all administrative members of AIMR as well.

#### 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.

AIMR is continuing to make efforts to advance organizational reform to maintain its excellent environment as a world leading research center. In FY2014, some instances of organizational reform established at AIMR, such as providing administrative services in English and a joint appointment system, started to be internalized by the host institution, Tohoku University. Implementation of these measures of the whole university are stipulated in "**SATOMI VISION**," the president's action plan which was announced in August 2013, and "**Tohoku University Global Vision**" which was known to the public in May 2014.

In July 2014, Tohoku University established the "**Organization for Advanced Studies (OAS)**" which was modeled upon AIMR's internationalization and system reform, in order to construct an international research environment and support system that gathers world-leading researchers at Tohoku University, and creates new scientific disciplines exceeding existing ones. AIMR was placed into OAS as the first institute and the Administrative Division of AIMR including the "International Relations Unit" will shift to the international administrative office of OAS, and play a central role in the internationalization of Tohoku University. The support for researchers by Research Support Center (including Common Equipment Unit and Researcher Support Office) has also been widened and enriched.

The management is structured in a top-down decision-making way, with the Center Director working under the helpful advice of an Executive Committee, consisting of the Center Director, administrative director, and five group leaders, and the advice of the International Advisory Board (**Appendix 3-4**). In this fiscal year, the annual International Advisory Board meeting was held on March 18, 2015 at AIMR.

#### 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)

**Research plan and organization:** AIMR's research objective is to promote ongoing math-mate collaboration and establish new materials science, through which we can design new functional materials based on prediction. In the long-term, by utilizing the new predictive materials science, we will contribute to society through creating revolutionary Green Materials for "energy harvesting," "energy saving," and "environmental clean-up." In order to accomplish this goal, AIMR is making maximum efforts to push math-mate collaboration and strengthen the global research network for consolidating world-wide recognition of our challenge. AIMR plays a central role in organizing Graduate program for spintronics and the three months thematic program on spintronics from mathematics to device. To make the internal organization more compatible with math-mate collaboration, the current "Bulk Metallic Glasses" group will be reorganized as the "Non-equilibrium Materials" group on April 1<sup>st</sup>, 2015. Furthermore, the Mathematics Unit and Interface Unit will be integrated into the "Mathematical Science" group on April 1<sup>st</sup>, 2015 in order to deepen math-mate collaborations. Reinforcement of the partnership with the University of Chicago will strengthen international collaboration and the development of spin-centered materials science. The number and composition of PIs will be almost maintained. However, since its establishment, AIMR has replaced PIs from time to time to meet its research strategy and kept the average age around 55 years old. AIMR has maintained a flexible personnel system and promoted excellent young researchers to PI (professor) or Junior PI (associate professor), and will maintain this promotion system.

**Resources:** President Satomi pledged to prepare a budget and create ten new tenure positions to maintain AIMR. Using the tenure positions, a full professor from Durham University (molecular electronic materials) moved to AIMR with his research team, and a junior PI in spintronics was promoted to become a tenured PI. AIMR will continue employing talented researchers and promote excellent young researchers to PI or Junior PI. Those new members include researchers who can create next-generation trends through data driven materials science, using such as Topological Data Analysts. AIMR established the Industrial-Academic Partnership Project collaboration laboratories in AIMR with DENSO Corporation and Hitachi, Ltd. and has also started to participate in Cross-ministerial Strategic Innovation Promotion Program (SIP). Such reinforcement of partnership with industry gives good influence on increase of research funds. Actually, AIMR researchers obtained external research funds of 2.8 billion yen in FY2014. Based on these factors, it is expected that sufficient resources will be secured to maintain AIMR and AIMR's research activity.

**Sustenance after program funding ends:** Tohoku University has a high opinion of AIMR which is opening new research fields and expanding a global network. The university has also started measures to permanently maintain AIMR as the driving force behind the future development of Tohoku University. As described above, President Satomi pledged to prepare a budget and create 10 new tenure positions to maintain AIMR. AIMR has become the first institute of OAS established in FY2014, and AIMR has started to apply for proposals to the discretionary budget of the President, as well as for budget request and international research funds. AIMR's Administrative Division will be shifted to the administrative office of OAS, and will play a central role in the internationalization and organizational reform of Tohoku University. These are the concrete measures for the development of AIMR after WPI program funding ends.

## 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.

**Textbook for math-mate collaboration:** AIMR is preparing to publish "**SpringerBriefs in the Mathematics of Materials,**" the world's first textbook series for math-mate collaboration, and the introductory volume "Volume 1: A New Direction in Mathematics for Materials Science" will be published within 2015. The second and following volumes focusing on specific topics will also be published sequentially (also see the next section "7 Center's response to the results of the FY2014 follow-up").

**PR & Outreach:** Outreach activities are among the most important missions of the WPI program to make citizens know and understand WPI and the activities of individual WPI centers. AIMR's PR & Outreach Office made an effort to increase the publicity of AIMR through AIMR's website, for example by issuing the public magazine "AIMR Magazine," and holding events such as the joint events with Super Science High Schools (SSH) (**Appendix 6**). The PR & Outreach Office of AIMR helped researchers to issue press releases on the excellent work that AIMR's researchers achieved, which were shown in newspapers and other media (**Appendix 7**).

7. Center's response to the results of the FY2014 follow-up (including the results of the site visit)

\* Note how the center has responded to the results of FY2014 follow-up. However, if you have already provided this information, please indicate where in the report.

[Recommendation 1]

***AIMR is highly expected to create "new materials science capable of predicting new functions based on a mathematics-materials concept."***

[Response]

We are making maximum effort to create such new materials science using all our resources. As written in the section "2. Advancing fusion of various research fields," our math-mate collaboration has reached the final phase of "**integration**" after passing all the lower phases, "**interest,**" "**interaction,**" and "**inspire.**" Every day, at the present AIMR, mathematicians and materials scientists talk to each other without any hesitation, and naturally carry out their collaboration and publish papers together. We spent about three years to achieve this condition, but the spent time was definitely not a waste. We are ready to create new predictive materials science based on math-mate collaboration. All we have to do is to maintain this condition, and pile research results on the existing base.

[Recommendation 2]

***Its aspiration of developing new materials with innovative functions can only be realized through an interactive approach between theory and experiment. Good indications in this direction at AIMR are talented young scientists, a new research direction, and new methods for tackling the problems. Mathematicians and materials scientists have begun a dialogue on an equal footing. A two-way cognitive effort, i.e. mathematician learning from materials science and vice versa, is required to accomplish the center's ultimate objectives.***

[Response]

As suggested by the Program Committee, a two-way cognitive effort is considerably important. Generally,

the style of collaboration is “role sharing.” For example, mathematicians take charge of mathematical parts and the collaborators take charge of what they are good at. However, researchers sometimes have to get over the wall (barrier) which divides disciplines, and learn and soak up substantial knowledge of the different disciplines to create a very new research field. AIMR is making as much effort as possible to produce real math-mate fusion through Fusion Research Proposal Program, Joint Seminars, Math-Mate Seminars, and Target Project–Interface Unit (TP–IU) Joint Forum.

[Recommendation 3]

*One effective way for mathematicians to learn from materials science might be to publish a textbook on materials science written by mathematicians themselves. As this would spawn further results, it is recommended that a strategic working group be set up within AIMR to prepare the publication of a math-based materials science textbook.*

[Response]

AIMR is preparing to publish a series of text book for math-mate collaboration “**SpringerBriefs in the Mathematics of Materials**” as described in the section “6. Others.” There is a world trend of math-other field interaction and the importance of mathematics in materials science has started to be recognized in Materials Informatics and some projects such as “Materials Genomics Initiative (MGI)” in the United States. If the publication of this textbook series will be completed, AIMR will gain a reputation as the first institute in the world to publish a standard textbook for math-mate collaboration.

## List of Center's Research Results and Main Awards

### A. Refereed Papers

List only the Center's papers published in 2014. (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 2014, 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 2011 may not be aware of this requirement, their papers are treated as "WPI-related papers." From 2012, 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).*

(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 .csv 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 2014.
- 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

## A. WPI papers

### A-1. Original articles

1. Kiss, D., Large deviation bounds for the volume of the largest cluster in 2D critical percolation. *Electron. Commun. Probab.* **19**, 1-11 (2014).
2. Kubo, M., Takahashi, Y., Fujii, T., Liu, Y., Sugioka, K., Tsukada, T., Minami, K., Adschiri, T., Thermal Dewetting Behavior of Polystyrene Composite Thin Films with Organic-Modified Inorganic Nanoparticles. *Langmuir* **30**, 8956-8964 (2014).
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#### **A-4. Other English articles**

N/A

#### **A-5. Articles written in other than English**

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### **B. WPI-related papers**

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#### **B-2. Review articles**

N/A

#### **B-3. Proceedings**

N/A

#### **B-4. Other English articles**

N/A

#### **B-5. Articles written in other than English**

N/A

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

- List up to 10 main presentations during FY2014 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	Katsumi Tanigaki, "The true ground states of poly(aromatic hydrocarbon) intercalated with alkali and alkaline earth metals," Study of Matter at Extreme Conditions (SMEC), Miami, U.S.A, March 8-13, 2015. (Invited Talk).
2	Shin-ichi Orimo, "Cool hydrides, again!," 9th International Symposium "Hydrogen & Energy," Emmetten, Switzerland, January 25-30, 2015. (Commemorative Lecture for Science of Hydrogen & Energy Award 2015)
3	Yuichi Ikuhara, "Grain Boundary Atomic Structures and Properties of Ceramics," The 3rd International Symposium on Hybrid Materials and Processing (HyMaP 2014), Busan, Korea, November 13, 2014. (Plenary Lecture)
4	Kosmas Prassides, "Strongly correlated molecular superconductors," Ushimado International Workshop on Physics and Chemistry of Novel Superconductors and related Materials, Ushimado, Okayama Prefecture, November 8-10, 2014. (Keynote Lecture)
5	Hideo Ohno, "Properties of CoFeB-MgO magnetic tunnel junctions down to 11nm," SPIE NanoScience +Engineering, San Diego, U.S.A., August 19-21, 2014. (Keynote Lecture)
6	Kazue Kurihara, "Current Status of Women Scientists in Japan," 248th ACS National Meeting, San Francisco, U.S.A., August 10-14, 2014. (Plenary Lecture)
7	Mingwei Chen, "Ultrastable metallic glasses," International Symposium on Metastable, Amorphous and Nanostructured Materials (ISMANAM) 2014, Cancún, México, June 29 to July 4, 2014. (Plenary Lecture)
8	Tomokazu Matsue, "High-Resolution Electrochemical Imaging with Nanoelectrode Systems," Italian-German-Japanese Meeting of Electrochemists, Padova, Italy June 15, 2014. (Invited Talk)
9	Tadafumi Adschiri, "Supercritical Route for Materials Synthesis," 14th European Meeting on Supercritical Fluids, Marseilles, France, May 21, 2014. (Plenary Lecture)
10	Yasumasa Nishiura, "Multi-state network for loop searching system with self-recovery property," Pattern Formation: mathematics and materials, Australian National University, Canberra, Australia, April 30, 2014. (Invited Talk)



## C. Major Awards

- List up to 10 main awards received during FY2014 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	Science of Hydrogen & Energy Award 2015, January 25, 2015. (Shin-ichi Orimo)
2	IEEE Andrew S. Grove Award 2015, January 18, 2015. (Masayoshi Esashi)
3	Materials Today Conference Award, Elsevier, December 12, 2014. (Mingwei Chen)
4	The American Institute of Chemical Engineers (AIChE) Nanoscale Science and Engineering Forum (NSEF) Young Investigator Award, November 16, 2014. (Ali Khademhosseini)
5	Elected as a member of American Academy of Arts and Sciences, October 11, 2014. (Paul S. Weiss)
6	Three PIs of AIMR were named as Thomson Reuters Highly Cited Researchers 2014, June 23, 2014. (Mingwei Chen, Takashi Takahashi and Ali Khademhosseini)
7	Services Prize of The Society of Japanese Women Scientists, June 22, 2014. (Kazue Kurihara)
8	Elected as an Academician in World Academy of Ceramics, June 10, 2014. (Yuichi Ikuhara)
9	The 11 <sup>th</sup> Honda Frontier Prize, May 29, 2014. (Takashi Takahashi)
10	Royal Society Wolfson Research Merit Award for research on New Chemistry of Functional Molecular materials (5 years, 2014-2019). (Kosmas Prassides)

## FY 2014 List of Principal Investigators

## NOTE:

- Underline names of principal investigators who belong to an overseas research institution.
- In case of researchers not listed in the latest report, attach "Biographical Sketch of a New Principal Investigator".

<Results at the end of FY2014>									
Principal Investigators Total: 30									
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  Motoko Kotani* (55)	Professor, AIMR, Tohoku University	Dr. of Science, Mathematics (Geometry)	40%	50%	10%	0%	Director: From Apr. 2012 Deputy Director: From May 2011 PI: From Mar. 2011	Usually stays at the center	
Tadafumi Adschiri* (57)	Professor, AIMR, Tohoku University	Dr. of Engineering, Hybrid materials, Super-critical Fluid Technology	80%	0%	0%	20%	From start	Usually stays at the center	
Mingwei Chen* (49)	Professor, AIMR, Tohoku University	Dr. of Engineering, Materials Science	100%	0%	0%	0%	From start	Usually stays at the center	
Masayoshi Esashi* (66)	Professor, AIMR, Tohoku University	Dr. of Engineering Sensors, Micro Electro Mechanical Systems	80%	0%	0%	20%	From start	Usually stays at the center	

Hiroyuki Isobe* (44)	Professor, AIMR, Tohoku University	Ph.D., Organic Chemistry	80%	0%	10%	10%	From Apr. 2013	Usually stays at the center	
Kazue Kurihara* (64)	Professor, AIMR, Tohoku University	Dr. of Physical Chemistry, Colloid and Interface Science	80%	0%	0%	20%	From Apr. 2010	Usually stays at the center	
Dmitri V. Louzguine* (47)	Professor, AIMR, Tohoku University	Dr. of Engineering, Materials Science	100%	0%	0%	0%	Professor: From Dec. 2007 PI: From 2009	Usually stays at the center	
Shigemi Mizukami* (42)	Professor, AIMR, Tohoku University	Dr. of Engineering, Applied Physics, Spintronics	100%	0%	0%	0%	From Nov., 2014	Usually stays at the center	
Tomokazu Matsue* (61)	Professor, AIMR, Tohoku University	Dr. of Pharmacy, Biosensing Engineering	80%	0%	0%	20%	From Nov. 2010	Usually stays at the center	
Yasumasa Nishiura* (64)	Professor, AIMR, Tohoku University	Dr. of Science, Applied Mathematics (Nonlinear Dynamics)	100%	0%	0%	0%	From Feb. 2012	Usually stays at the center	
Shin-ichi Orimo* (49)	Professor, AIMR, Tohoku University	Ph.D., Materials Engineering and Chemistry	80%	0%	0%	20%	From Jan. 2013	Usually stays at the center	
Kosmas Prassides* (57)	Professor, AIMR, Tohoku University	D.Phil. in Chemistry	20%	0%	45%	35%	From Apr. 2013	Usually stays at the center	

Eiji Saitoh* (43)	Professor, AIMR, Tohoku University	Dr. of Engineering, Spintronics	80%	0%	0%	20%	From Apr. 2012	Usually stays at the center	
Takashi Takahashi* (63)	Professor, AIMR, Tohoku University	Dr. of Science, Solid-State Physics	80%	0%	0%	20%	From start	Usually stays at the center	
Katsumi Tanigaki* (60)	Professor, AIMR, Tohoku University	Dr. of Engineering, Nano Materials Science	80%	0%	0%	20%	From start	Usually stays at the center	
Hideo Ohno* (60)	Professor, Research Institute of Electrical Communication, Tohoku University	Dr. of Engineering, Semiconduct or Physics and Engineering, Spintronics	40%	0%	40%	20%	From Apr. 2012	Usually stays at the Institute of Research Institute of Electrical Communication, close to the center, and participate in the center's activities	
Seiji Samukawa* (56)	Professor, Institute of Fluid Science, Tohoku University	Dr. of Nanoprocess Engineering	40%	0%	40%	20%	From Apr. 2012	Usually stays at the Institute of Fluid Science, close to the center, and participate in the center's activities	
Yuichi Ikuhara* (56)	Professor, School of Engineering, University of Tokyo	Dr. of Engineering, Physical Metallurgy	40%	0%	40%	20%	From start	Stays at the center every two weeks	
<u>Tomasz Dietl</u> * (64)	Professor, Head of Laboratory of Cryogenic and Spintronic Research, Institute of Physics, Polish Academy of Sciences	Dr. Hab., physics of semiconduct ors and magnetic materials, low-temperat ure physics	20%	0%	45%	35%	From Apr. 2012	<ul style="list-style-type: none"> <li>• Stays at the center once (for two weeks) a year</li> <li>• Dispatches a researcher who belongs to the same institute with PI to give an invited lecture at the AIMR conference</li> </ul>	

<u>Thomas Gessner</u> * (60)	Professor, Center for Microtechnologies, Chemnitz University of Technology	Ph.D. in Device Science/ Technology	30%	0%	50%	20%	From start	<ul style="list-style-type: none"> <li>• Stays at the center twice a year</li> <li>• Attends the AIMR conference</li> <li>• Sends young scientists to the center</li> <li>• Dispatches a researcher who belongs to the same institute with PI to give an invited lecture at the AIMR conference</li> </ul>	Send young scientists to the WPI center (1/6.5 years since 2008) (1/2.3 years since 2012) (1/1 year) (1/6 months)
<u>Alain Lindsay Greer</u> * (59)	Professor, Department of Materials Science & Metallurgy, University of Cambridge	Ph.D. in Metallurgy & Materials Science	20%	0%	45%	35%	From start	<ul style="list-style-type: none"> <li>• Stays at the center twice a year</li> <li>• Attends the AIMR conference</li> <li>• Sends young scientists to the center</li> </ul>	Send young scientist to the WPI center (3/2 weeks each) (2/1 week each)
<u>Thomas P. Russell</u> * (62)	Professor, Department of Polymer Science and Technology, University of Masachu- setts Amherst	Ph.D. in Nano- Science Technology	20%	0%	45%	35%	From start	<ul style="list-style-type: none"> <li>• Stays at the center twice a year</li> <li>• Attends the AIMR conference</li> </ul>	
<u>Alexander Shluger</u> * (60)	Professor, Department of Physics and Astronomy, University College London	Ph.D. in Computational Materials Science, Condensed Matter Physics	35%	0%	45%	25%	From start	<ul style="list-style-type: none"> <li>• Stays at the center three times (one month in total) a year</li> <li>• Sends young scientists to the center</li> <li>• Dispatches a researcher who belongs to the same institute with PI to give an invited lecture at the AIMR conference</li> </ul>	Send young scientists to the WPI center (1/2.4 years since 2012) (1/3 weeks)
<u>Li-Jun Wan</u> * (57)	Professor, Institute of Chemistry, Chinese Academy of Science	Ph.D. in SPM, Physical Chemistry, Nanoscience and technology	20%	0%	45%	35%	From start	<ul style="list-style-type: none"> <li>• Stays at the center once a year</li> <li>• Sends young scientists to the center</li> </ul>	Send young scientist to the WPI center (1/1.5 years since 2013)
<u>Paul S. Weiss</u> * (55)	Professor, Department of Chemistry and Biochemistry, University of California, Los Angeles	Ph.D. in Surface Science	20%	0%	45%	35%	From start	<ul style="list-style-type: none"> <li>• Sends young scientists to the center</li> </ul>	Send young scientist to the WPI center (1/2.9 years since 2012)

<u>Qi-kun Xue</u> * (51)	Professor, Department of Physics, Tsinghua University	Ph.D. in Surface Science	20%	0%	45%	35%	From start		
<u>Alain Reza Yavari</u> * (65)	Professor, Grenoble Institute of Technology	Ph.D. in Physical Metallurgy	30%	0%	45%	25%	From start	<ul style="list-style-type: none"> <li>• Stays at the center twice (one month in total) a year</li> <li>• Attends the AIMR conference</li> <li>• Sends young scientists to the center</li> </ul>	Send young scientists to the WPI center (1/6.9 years since 2008) (1/2 months)
<u>Ali Khademhosseini</u> * (39)	Associate Professor, Medical School, Harvard University	Ph.D. in Bioengineeri ng	35%	0%	45%	20%	From Nov. 2009	<ul style="list-style-type: none"> <li>• Stays at the center twice a year</li> <li>• Joins a videoconference regularly from the home institution (Harvard Univ.)</li> </ul>	Send young scientists to the WPI center (1/4.9 years since 2010) (1/4 years since 2011) (1/2.1 years since 2012) (1/1.5 months Since 2013) (1/7 months)
<u>Winfried Teizer</u> * (44)	Associate Professor, Department of Physics, Texas A&M University	Ph.D. in Physics	35%	0%	40%	25%	From Nov. 2009	<ul style="list-style-type: none"> <li>• Stays at the center several times (more than four months in total) a year</li> <li>• Joins a videoconference regularly from the home institution (Texas A&amp;M Univ.)</li> </ul>	Send young scientists to the WPI center (1/4.4 years since 2010) (1/4.3 years since 2011) (1/3 months)
<u>Hongkai Wu</u> * (36)	Associate Professor, Department of Chemistry, Hong Kong University of Science and Technology	Ph.D. in Chemistry	35%	0%	45%	20%	From Nov. 2009	<ul style="list-style-type: none"> <li>• Stays at the center for a month</li> <li>• Joins a videoconference regularly from the home institution (Hong Kong Univ. of Sci. &amp; Tech.)</li> </ul>	Send young scientists to the WPI center (1/4.5 years since 2010) (1/4.1 years since 2011)

**Researchers unable to participate in project in FY 2014**

Name	Affiliation (Position title, department, organization)	Starting date of project participation	Reasons	Measures taken
Masatsugu Shimomura	Professor, Faculty of Photonics Science, Chitose Institute of Science and Technology	From start	To concentrate on the research at the Chitose Institute of Science and Technology	
Benoit Collins	Associate Professor, Graduate School of Science, Kyoto University	From April, 2013	To concentrate on the research at the Kyoto University	

## Records of FY2014 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 at [OO month, OO year (next year of the end of WPI grant)].

	Goal set in the "Post-interim evaluation revised center project"	Results at end of FY 2014	Final goal (Date: March, 2017)
Researchers	146 < 73, 50%> [ 22, 15%]	154 < 72, 47%> [ 12, 8%]	146 < 73, 50%> [ 22, 15%]
Principal investigators	33 < 12, 36%> [ 2, 6%]	30 < 15, 50%> [ 2, 7%]	33 < 12, 36%> [ 2, 6%]
Other researchers	113 < 59, 52%> [ 20, 18%]	124 < 57, 46%> [ 10, 8%]	113 < 59, 52%> [ 20, 18%]
Research support staffs	50	86	50
Administrative staffs	24	30 (28, 93%)	24 (22, 92%)
Total	220	270	220

#### 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.
- 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.

"GI<sup>3</sup> (Global Intellectual Incubation and Integration) Laboratory" was inaugurated in FY2009 to motivate prominent researchers (including graduate students) to converge on AIMR from all over the world. The laboratory is designed to become a center of the brain circulation where researchers specializing in materials science can undertake internationally collaborative and fusion research activities. The GI<sup>3</sup> system has led to active exchange with researchers from countries all over the world.

The number of researchers who visited AIMR in FY2014 within the framework of GI<sup>3</sup> was 4 senior researchers (professors and associate professors) and 3 young researchers (assistant professors, post-docs, and graduate students).

The following are examples of prominent researchers studying on a full-time basis who are part of the global brain circulation of researchers.



(Newly appointed or promoted)

1. PI, appointed from Durham University, UK
2. PI, promoted from Associate Professor of AIMR
3. Associate Professor, promoted from Assistant Professor of AIMR

(Promoted or moved to distinguished institutions)

1. Assistant Professor, promoted to Professor of Huazhong University of Science and Technology, China
2. Assistant Professor, promoted to Professor of South China University of Technology, China
3. Assistant Professor, promoted to Professor of Northeastern University, China

#### 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 Cambridge	Alan Lindsay Greer Bill Jones	Principal Investigator Adjunct professor
Institute of Chemistry, Chinese Academy of Sciences	Li-Jun Wan	Principal Investigator
University of California, Santa Barbara	Fred Wudl	Adjunct professor

#### < Partner institutions>

Institution name	Principal Investigator(s), if any	Notes
University of Wisconsin-Madison	John H. Perepezko	Adjunct professor
Grenoble Institute of Technology	Alain Reza Yavari	Principal Investigator
Polish Academy of Sciences	Tomasz Dietl	Principal Investigator
University College London	Alexander Shluger Peter Sushko	Principal Investigator Adjunct Associate professor
Texas A&M University	Winfried Teizer	Principal Investigator
University of California, Los Angeles	Paul S. Weiss	Principal Investigator
Tsinghua University	Qi-Kun Xue	Principal Investigator
University of Massachusetts Amherst	Thomas P. Russell	Principal Investigator
Chemnitz University of Technology	Thomas Gessner	Principal Investigator
Harvard University	Ali Khademhosseini	Principal Investigator
Hong Kong University of Science & Technology	Hongkai Wu	Principal Investigator
The University of Tokyo	Yuichi Ikuhara	Principal Investigator

## 2. Securing competitive research funding

- Competitive and other research funding secured in FY2014:

Total: 2,804,580,760yen

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

The followings are the external funds warranting special mention which were continued in FY2014. Each total amount shows the sum total of the fund from the year of adoption to FY2016 in order to show the size of the research appropriately.

### 【Exploratory Research for Advanced Technology (ERATO)】

- Chief Researcher : Prof. Hiroyuki Isobe  
Total amount (FY2013-) : 850 million yen
- Chief Researcher : Prof. Eiji Saitoh  
Total amount (FY2014-) : 433 million yen

### 【Core Research for Evolutionary Science and Technology (CREST)】

- Chief Researcher : Prof. Mingwei Chen  
Total amount (FY2011-) : 238 million yen
- Chief Researcher : Prof. Eiji Saitoh  
Total amount (FY2012-) : 51 million yen

### 【Advanced Low Carbon Technology Research and Development Program (ALCA)】

- Chief Researcher : Prof. Tomokazu Matsue  
Total amount (FY2013-) : 20 million yen
- Chief Researcher : Lecturer Atsushi Unemoto  
Total amount (FY2013-) : 29 million yen

### 【Development of Systems and technology】

- Chief Researcher : Prof. Tomokazu Matsue  
Total amount (FY2012-) : 114 million yen

### 【Adaptable and Seamless Technology transfer Program (A-Step)】

- Chief Researcher : Associate Prof. Koji Nakayama  
Total amount (FY2013-) : 19 million yen

### 【Cross-ministerial Strategic Innovation Promotion Program (SIP)】

- Chief Researcher : Prof. Kazue Kurihara  
Total amount (FY2014-) : 20 million yen
- Chief Researcher : Prof. Tadafumi Adschiri  
Total amount (FY2014-) : 25 million yen
- Chief Researcher : Prof. Yasumasa Nishiura  
Total amount (FY2014-) : 19 million yen

### 【Gran-in-Aid for Scientific Research Scientific Research S】

- Chief Researcher : Prof. Takashi Takahashi  
Total amount (FY2011-) : 211 million yen
- Chief Researcher : Prof. Shin-ichi Orimo  
Total amount (FY2013-) : 89 million yen

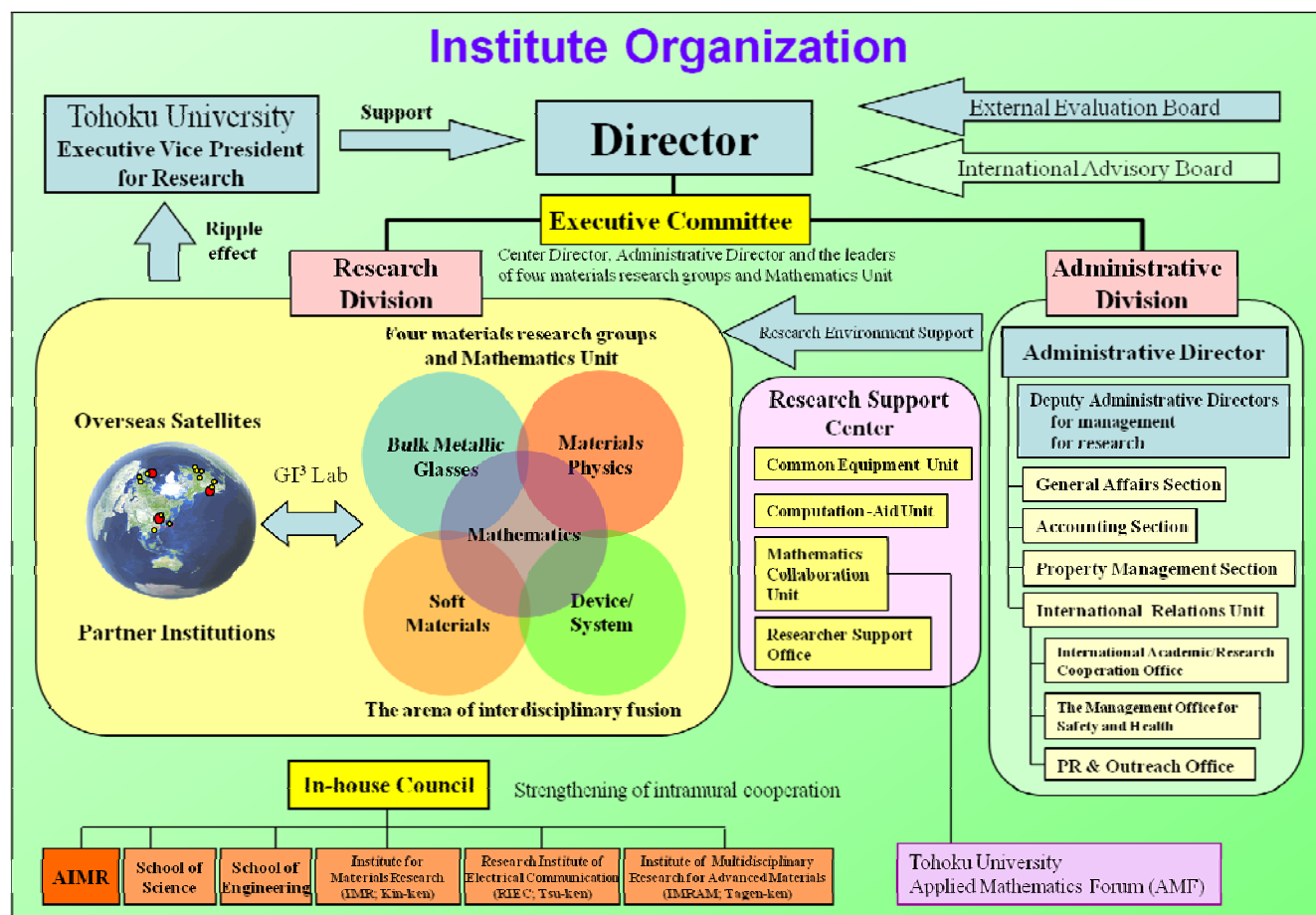
## 3. International research conferences or symposiums held to bring world's leading researchers together

- Indicate the number of international research conferences or symposiums held in FY2014 and give up to three examples of the most representative ones using the table below.

FY 2014: 3 meetings	
Major examples (meeting title and place held)	Number of participants
AIMR International Symposium 2015 (AMIS2015) (Sendai)	From domestic institutions: 233 From overseas institutions: 35
1 <sup>st</sup> UChicago/AIMR JRC Workshop (Sendai)	From domestic institutions: 45 From overseas institutions: 5
3 <sup>rd</sup> Cambridge/AIMR Joint Workshop (UK)	From domestic institutions: 20 From overseas institutions: 30

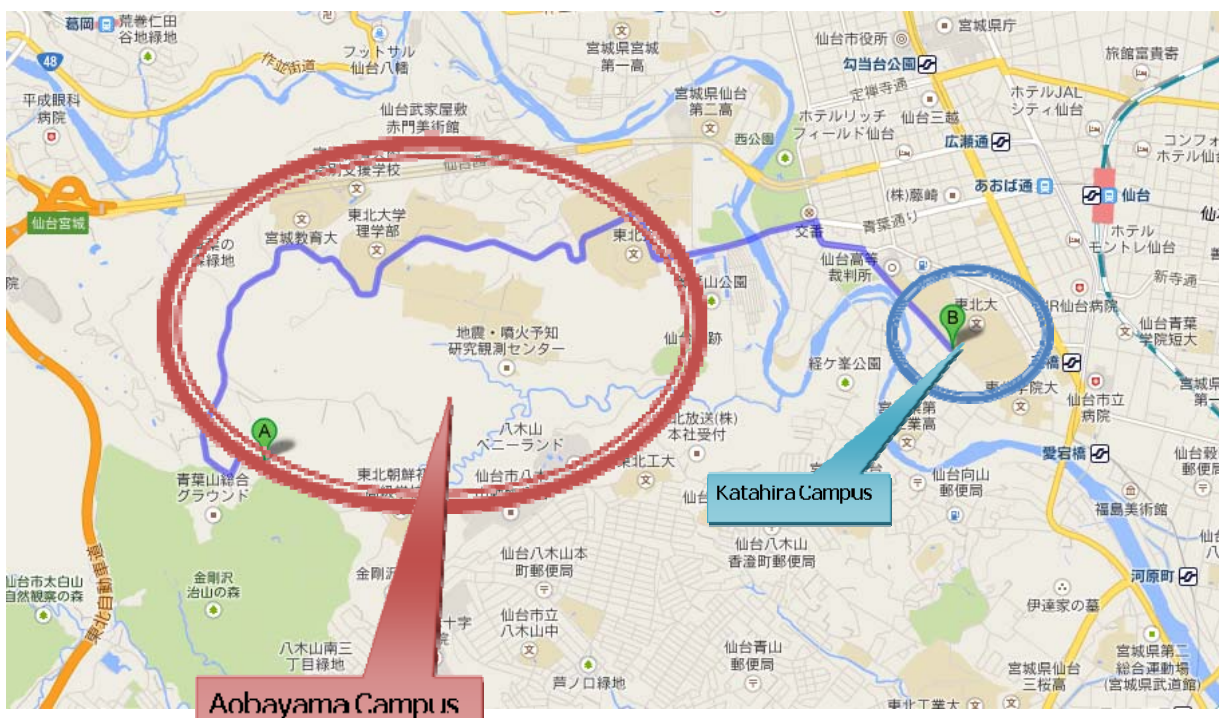
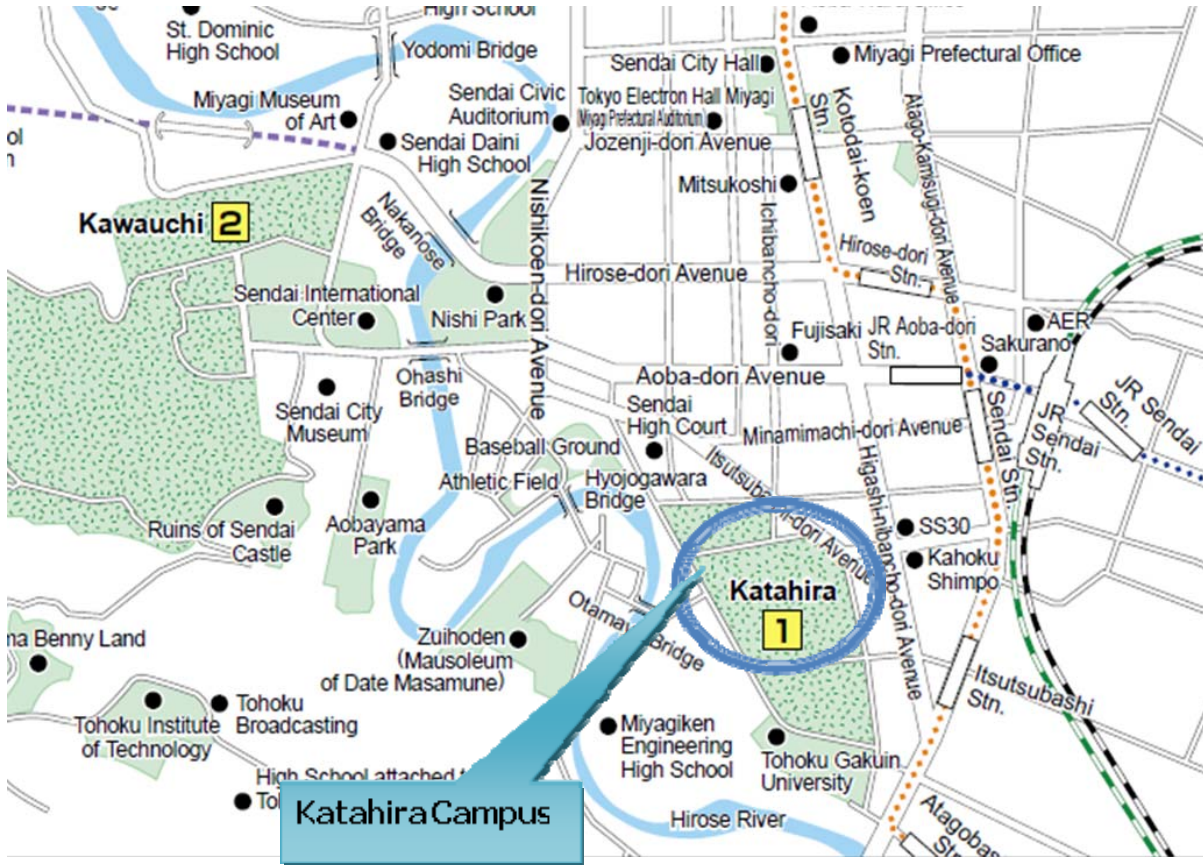
## 4. Center's management system

- 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)

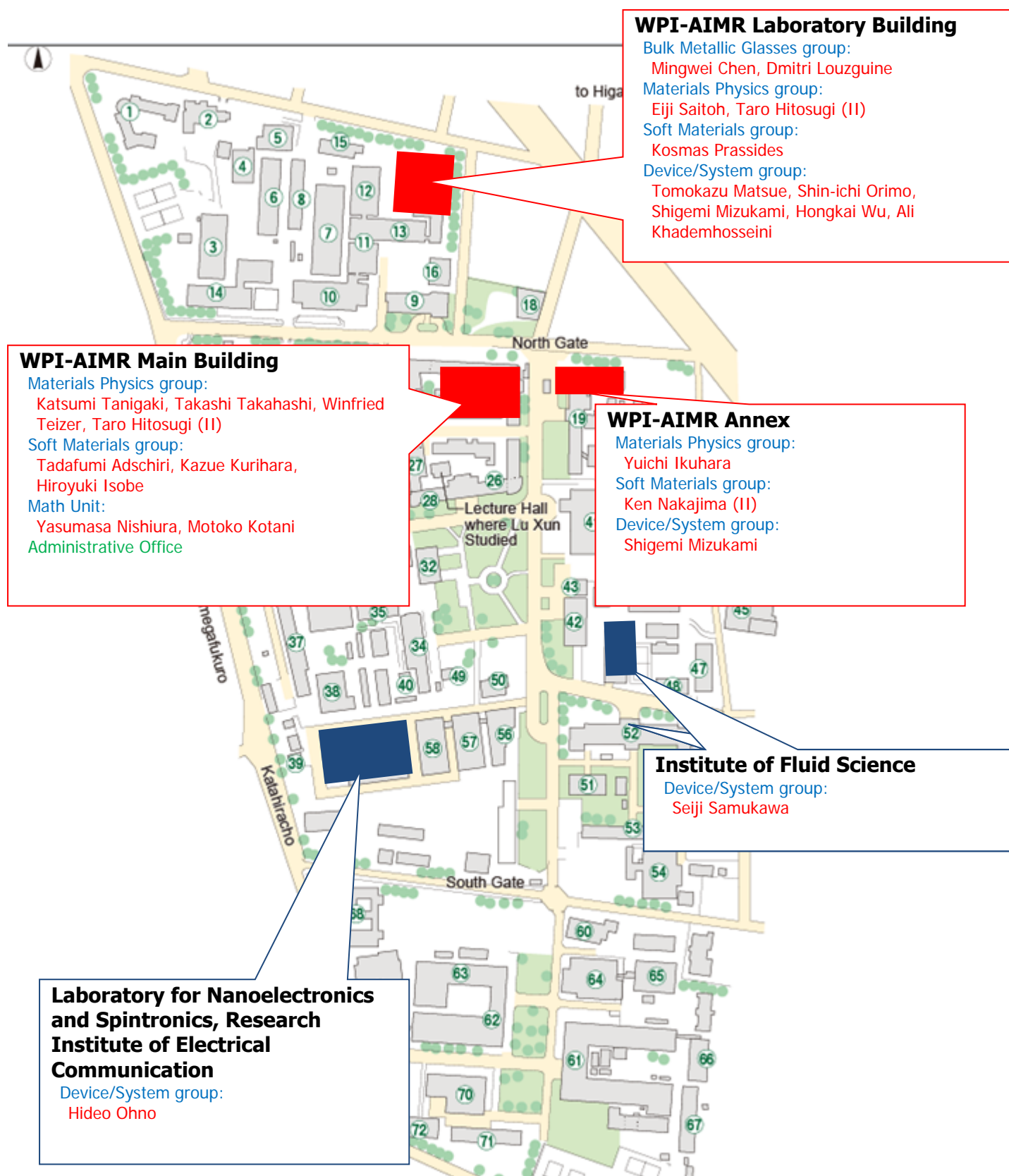


5. Campus Map

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



## 【Katahira Campus】



【Aobayama Campus】



**Micro System Integration Center (μSIC)**  
Device/System group:  
Masayoshi Esashi

i) Overall project funding

Cost Items	Details	Costs (10,000 dollars)
Personnel	Center director and Administrative director	24
	Principal investigators (no. of persons):18	180
	Other researchers (no. of persons):96	575
	Research support staffs (no. of persons):41	52
	Administrative staffs (no. of persons):49	180
	Total	1011
Project activities	Gratuities and honoraria paid to invited principal investigators (no. of persons):12	14
	Cost of dispatching scientists (no. of persons):	
	Research startup cost (no. of persons):33	122
	Cost of satellite organizations (no. of satellite organizations):1	25
	Cost of international symposiums (no. of symposiums):1	47
	Rental fees for facilities	
	Cost of consumables	44
	Cost of utilities	81
	Other costs	111
Total	444	
Travel	Domestic travel costs	4
	Overseas travel costs	23
	Travel and accommodations cost for invited scientists (no. of domestic scientists):2 (no. of overseas scientists):22	12
	Travel cost for scientists on secondment (no. of domestic scientists): (no. of overseas scientists):1	1
	Total	40
Equipment	Depreciation of buildings	110
	Depreciation of equipment	1253
	Total	1363
Other research projects	Projects supported by other government subsidies, etc.	
	Commissioned research projects, etc.	1335
	Grants-in-Aid for Scientific Research, etc.	327
Total	1662	
Total		4520

Ten thousand dollars

WPI grant	1310
Cost of equipment procured	687
Spintronics Materials Properties Measurement System Number of units: 1 Costs paid:	33
Low Temperature Unit for Nuclear Magnetic Resonance Spectrometer Number of units: 1 Costs paid:	24
Magnetron Sputtering Equipment for Research and Development Number of units: 1 Costs paid:	13
Multiway Evaporation Equipment Number of units: 1 Costs paid:	12
Calculation Server for Topological Data Analysis Number of units: 1 Costs paid:	11
STM Control System Number of units: 1 Costs paid:	11
Cell Test System Number of units: 1 Costs paid:	10
High Temperature Sublimation Purification system Number of units: 1 Costs paid:	8
Nanofiber Production Equipment Number of units: 1 Costs paid:	8
High Temperature Differential Scanning Calorimeter Number of units: 1 Costs paid:	8
Others	549

ii) Costs of Satellites and Partner institutions

Cost Items	Details	Costs (10,000 dollars)
Personnel	Principal investigators (no. of persons):2	/
	Other researchers (no. of persons):16	
	Research support staffs (no. of persons):	
	Administrative staffs (no. of persons):	
Total	87	
Project activities		39
Travel		16
Equipment		
Other research projects		
Total		142



## Status of Collaboration with Overseas Satellites

### 1. Coauthored Papers

- List the refereed papers published in FY2014 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. Let it free, if the paper is published in between Jan.-Mar. 2015 and not described in Appendix 1.

#### Overseas Satellite 1: University of Cambridge (Total: 7 papers)

No.	Author names and details
1-(1)	<i>Kiss, D.</i> , Large deviation bounds for the volume of the largest cluster in 2D critical percolation. <i>Electron. Commun. Probab.</i> <b>19</b> , 1-11 (2014).
1-(93)	Nachum, S., <i>Greer, A.L.</i> , Indentation size effect in metallic glasses: Mean pressure at the initiation of plastic flow. <i>J. Alloy. Compd.</i> <b>615</b> , S98-S101 (2014).
1-(94)	Louzguine-Luzgin, D.V., Louzguina-Luzgina, L.V., Ketov, S.V., Zadorozhnyy, V.Y., <i>Greer, A.L.</i> , Influence of cyclic loading on the onset of failure in a Zr-based bulk metallic glass. <i>J. Mater. Sci.</i> <b>49</b> , 6716-6721 (2014).
1-(95)	Sun, Y.H., Louzguine-Luzgin, D.V., Ketov, S., <i>Greer, A.L.</i> , Pure shear stress reversal on a Cu-based bulk metallic glass reveals a Bauschinger-type effect. <i>J. Alloy. Compd.</i> <b>615</b> , S75-S78 (2014).
1-(96)	Seddon, A.B., Abdel-Moneim, N.S., Zhang, L., Pan, W.J., Furniss, D., Mellor, C.J., Kohoutek, T., <i>Orava, J.</i> , Wagner, T., Benson, T.M., Mid-infrared integrated optics: versatile hot embossing of mid-infrared glasses for on-chip planar waveguides for molecular sensing. <i>Opt. Eng.</i> <b>53</b> , 71824 (2014).
1-(97)	<i>Orava, J.</i> , <i>Greer, A.L.</i> , Fast and slow crystal growth kinetics in glass-forming melts. <i>J. Chem. Phys.</i> <b>140</b> , 214504 (2014).
1-(199)	Louzguine-Luzgin, D.V., Ketov, S.V., <i>Orava, J.</i> , Mizukami, S., Optically transparent magnetic and electrically conductive Fe-Cr-Zr ultra-thin films. <i>Phys. Status Solidi A-Appl. Mat.</i> <b>211</b> , 999-1004 (2014).

#### Overseas Satellite 2: Institute of Chemistry, Chinese Academy of Sciences (Total: 2 papers)

No.	Author names and details
2-(75)	Zhang, W.H., Sun, Y., Zhang, J.S., Li, F.S., Guo, M.H., Zhao, Y.F., Zhang, H.M., Peng, J.P., Xing, Y., Wang, H.C., Fujita, T., Hirata, A., Li, Z., Ding, H., Tang, C.J., Wang, M., Wang, Q.Y., He, K., Ji, S.H., Chen, X., Wang, J.F., Xia, Z.C., Li, L., Wang, Y.Y., Wang, J., Wang, L.L., Chen, M.W., <i>Xue, Q.K.</i> , Ma, X.C., Direct Observation of High-Temperature Superconductivity in One-Unit-Cell FeSe Films. <i>Chin. Phys. Lett.</i> <b>31</b> , 17401 (2014).
2-(350)	Liu, H.W., Nishitani, R., Fujita, T., Li, W., Zhang, L., Lang, X.Y., Richard, P., Nakayama, K.S., Chen, X., Chen, M.W., <i>Xue, Q.K.</i> , Inelastic electron-tunneling spectroscopy of nanoporous gold films. <i>Phys. Rev. B</i> <b>89</b> , 35426 (2014).

## Overseas Satellite 3: University of California, Santa Barbara (Total: 3 papers)

No.	Author names and details
3-(347)	Dou, L.T., Zheng, Y.H., Shen, X.Q., Wu, G., Fields, K., Hsu, W.C., Zhou, H.P., Yang, Y., <i>Wudl, F.</i> , Single-Crystal Linear Polymers Through Visible Light-Triggered Topochemical Quantitative Polymerization. <i>Science</i> <b>343</b> , 272-277 (2014).
3-(348)	Zheng, Y.H., Miao, M.S., Zhang, Y., Nguyen, T.Q., <i>Wudl, F.</i> , Striking Effect of Intra- versus Intermolecular Hydrogen Bonding on Zwitterions: Physical and Electronic Properties. <i>J. Am. Chem. Soc.</i> <b>136</b> , 11614-11617 (2014).
3-(349)	Zheng, Y.H., <i>Wudl, F.</i> , Organic spin transporting materials: present and future. <i>J. Mater. Chem. A</i> <b>2</b> , 48-57 (2014).

## 2. Status of Researcher Exchanges

- Using the below tables, indicate the number and length of researcher exchanges in FY2014. 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: University of Cambridge

&lt;To satellite&gt;

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2014	5				5
	9	1			10

&lt;From satellite&gt;

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2014	1	1			2
	2	3			5

## Overseas Satellite 2: Institute of Chemistry, Chinese Academy of Sciences

&lt;To satellite&gt;

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2014					0
					0

&lt;From satellite&gt;

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2014	1				1

## Overseas Satellite 3: University of California, Santa Barbara

## &lt;To satellite&gt;

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2014					0
	2				2

## &lt;From satellite&gt;

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2014					0
		1			1

## FY 2014 Visit Records of World Top-caliber Researchers from Abroad

Researchers Total: 82

Name	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)
Elsa Weiss	Assistant Professor, Ecole des Mines Albi, RAPSODEE, CNRS	Ph.D., Engineering processes and Environment, Carbonization and synthesis of composite materials by hydrothermal reaction of biomass	Committee member of WasteEng Symposium	03-12 Apr, 2014	Stay for cooperative research
Arcon Denis	Professor, Jožef Stefan Institute	Ph.D., Magnetic resonance (NMR, EPR and muSR)	Award of The International Union for Materials Research (IUMRS) (1997) The Golden Emblem of IJS (1998) National Zois Award (2008)	08-11 Apr, 2014	Giving a lecture for collaborative researches in JSPS (Two-country Collaborative Research program)
TEIZER WINFRIED	Associate Professor, Texas A&M University	Ph.D., Physics Biophysics	Montague/Center for Teaching Excellence Scholar, Texas A&M University (2004)	25 Apr - 04 May, 2014  01 Jun - 29 Aug, 2014  26 Nov - 11 Dec, 2014  06-17 Jan, 2015  09-20 Feb, 2015	Participation as Principle Investigator  Participation in AIMR International Symposium 2015 (AMIS2015)
C. Barry Carter	Professor, Connecticut University	Ph.D., High-Resolution Microscopy	JSPS Fellowship (2014) MSA Distinguished Physical Scientist (2013) CINT Distinguished Affiliate Scientist (Sandia NM) Editor-in-Chief, Journal of Materials Science (Springer) President (2011-2014) of International Federation of Societies for Microscopy (IFSM) MRS Awards Committee Chair (2012-2014) Fellow AAAS (2011), MRS (2009), MSA (2009)	16 May 2014	Lecturer in a seminar

KHADEMHOSS EINI ALIREZA	Associate Professor, Harvard Medical University	Ph.D., Bioengineering from Massachusetts Institute of Technology	American Institute of Chemical Engineers (AIChE) Nanoscale Science and Engineering Forum (NSEF) Young Investigator Award (2014) American Chemical Society (ACS) Kavli Emerging Leader in Chemistry (2014) American Association for the Advancement of Science (AAAS) Fellow (2014) US National Academy of Engineering (NAE) and National Academy of Science (NAS) and Brazilian Academy of Sciences Frontiers of Science and Engineering - participant – (2014)	18-27 May, 2014  14-20 Feb, 2015	Participation as Principle Investigator  Participation in AIMR International Symposium 2015 (AMIS2015)
Hongkai Wu	Associate Professor, Hong Kong University of Science and Technology	Ph.D., Chemistry from Harvard University	Editorial Board of Biomicrofluidics DuPont Young Professor Award (2007-2010)	27 May - 24 Jun, 2014	Participation as Principle Investigator
SANTOS MICHAEL BANZON	Professor, The University of Oklahoma	Ph.D., Electrical Engineering from Princeton University		09 Jun - 18 Jul, 2014	Stay for joint research as Visiting Professor
CAZALILLA GUTIERREZ MIGUEL ANGEL	Professor, Department of Physics, National Tsing Hua University	Ph.D., Physics	Member of the American Physical Society (since 1998)	12-15 Jun, 2014	Lecturer in a seminar
MEYYAPPAN MEYYA	NASA	Ph.D., Chemical Engineering, Clarkson University	Presidential Meritorious Award NASA Outstanding Leadership Medal Arthur Flemming Award 2008 IEEE Judith Resnick Award IEEE-USA Harry Diamond Award The American Institute of Chemical Engineers Nanoscale Science and Engineering Forum Award	20-26 Jul, 2014  13-18 Feb, 2015	Short-term stay for joint research  Participation in AIMR International Symposium 2015 (AMIS2015)
Juin J. Liou	Professor, University of Central Florida	Ph.D., Electrical Engineering from University of Florida	Fellow of IET, Fellow of IEEE, IEEE EDS Education Award (2014) Lockheed Martin Professor of Engineering, University of Central Florida	24-25 Jul, 2014	Short-term stay for joint research

Yiming Li	Professor, National Chiao Tung University (NCTU), ECE,	Ph.D. from National Chiao Tung University	The 5-nm-gate Si Nanowire FET (world record; collaboration with tsmc) (2003) Research Fellowship Award presented by the Pan Wen-Yuan Foundation, Taiwan (2002) Outstanding Young Electrical Engineer Award from the Chinese Institute of Electrical Engineering, Taiwan (2006)	24-26 Jul, 2014 23-29 Nov, 2014 21 Jan - 21 Feb, 2015	Short-term stay for joint research  Participation in AIMR International Symposium 2015 (AMIS2015)
Voskoboynikov	Professor, National Chiao Tung University (NCTU), DEE,	Ph.D., Theoretical Physics and Physics of Semiconductors	State Prize of Ukraine in Science and Technology Distinguished grantee of the International Soros Foundation	24-31 Jul, 2014 21-31 Jan, 2015	Short-term stay for joint research
Blanka Magyari-Kope	Senior Research Engineer, EE, Stanford University	Ph.D., Theory of Materials	Member of the IEDM Modeling and Simulation Committee (2014) over 30 invited talks, one keynote, two book chapters and more than 70 scientific papers are published	24 Jul - 1 Aug, 2014	Short-term stay for joint research
MA EN EVAN	Professor, Johns Hopkins University	Ph.D. 1989, Tsinghua University	Fellow (2015) Thomson Reuters Highly Cited Researcher (2014) Senior Scientist Award, 18th International Symposium on Metastable, Amorphous and Nanocrystalline Materials (2011)	25 Jul – 02 Aug, 2014	Short-term stay for joint research
XU JIAN	Professor, Institute of Metal Research, Chinese Academy of Sciences	Ph.D., Materials Science		25 Jul – 02 Aug, 2014	Short-term stay for joint research
MALE CAMILLE FRANCOIS	Centre National de la Recherche Scientifique (CNRS)	Ph.D., Mathematics from Ecole Normale Supérieure de Lyon		26 Jul - 10 Aug, 2014	Discussion on research
ALEXANDER SHLUGER	Professor, University College London	Ph.D., Computational Materials Science	Fellow of the Institute of Physics (1996)  Fellow of the American Physical Society (2011)	27 Jul - 03 Aug, 2014 17-25 Nov, 2014 24 Mar - 03 Apr, 2015	Participation as Principal Investigator

PEREPEZKO JOHN HARRY	Professor, University of Wisconsin- Madison	Ph.D., Metallurgy and Materials Science from Carnegie Mellon University	Fellow Award Materials Research Society (2013) William Hume Rothery Award, TMS (2008)	29 Jul - 04 Aug, 2014  14-20 Feb, 2015	Short-term stay for discussion on research  Giving a talk at AIMR International Symposium 2015 (AMIS2015)
NIEH TAI-GANG	Professor, University of Tennessee	<ul style="list-style-type: none"> <li>• Metallic glasses (amorphous alloys)</li> <li>• Nanostructured materials</li> <li>• High temperature materials</li> </ul>	Fellow of TMS (The Materials, Minerals, and Metallurgical Society) (2004)  Fellow of ASM International (American Society of Materials) (1992)	01-03 Aug, 2014	Short-term stay for joint research
DIETL TOMASZ STANISLAW	Professor, Institute of Physics, Polish Academy of Sciences	Ph.D., Physics and Engineering of Spintronics Materials and Devices	Humboldt Research Award(2003) Agilent Technologies Europhysics Prize (2005) Prize of Foundation for Polish Science (2006)	12-26 Aug, 2014  14-29 Nov, 2014  4 Feb - 6 Mar, 2015	Participation as Principal Investigator  Lectures at Graduate Program in Spintronics of Tohoku University  Giving a talk at AIMR International Symposium 2015 (AMIS2015)  Visiting Professor of RIEC, Tohoku University
GREER ALAN LINDSAY	Professor, Mater. Sci. Metall., University of Cambridge	Ph.D., Metallic Glasses	The Hume Rothery Prize, the Griffith Medal	17-21 Aug, 2014  13-20 Feb, 2015	Participation in Site Visit as Principal Investigator  Participation in AIMR International Symposium 2015 (AMIS2015)
RUSSELL PAUL THOMAS	Professor, University of Massachusetts Amherst	Ph.D., Polymer Science and Engineering from University of Massachusetts Amherst	Editorial Board Member, Current Opinion in Chemical Engineering (since 2011) Honorary Distinguished Professor, Chinese Academy of Science, Changchun Institute of Applied Chemistry (since 2011) International Advisory Board, Chinese Journal of Polymer Science (since 2011)	17-22 Aug, 2014  14-20 Feb, 2015	Participation in Site Visit as Principal Investigator  Participation in AIMR International Symposium 2015 (AMIS2015) as Principal Investigator
WAN LIJUN	Professor, Director, Institute of Chemistry, Chinese Academy of Sciences	Ph.D., Materials Chemistry from Tohoku University	Fellow of Royal Society of Chemistry Vice President of Chinese Chemical Society President Elected of Chinese Society of Electrochemistry Chemistry Award of TWAS 2nd class Award of National Natural Science of China	18-20 Aug, 2014	Participation in Site Visit as Principal Investigator



Colin Nuckolls	Professor, Columbia University	Ph.D., Integrated reaction chemistry into electrical devices	A founding member of the Columbia University Nanoscience Center A recipient of a Sloan Research Fellowship Beckman Young Investigator Award ACS Arthur C. Cope Scholar Award (2008) ACS Baekeland Award (2009)	07-10 Sep, 2014	Participation in poc25 (25 <sup>th</sup> Symposium on Physical Organic Chemistry) and an invited lecture Discussions with researchers
LEE KA YEE CHRISTINA	Professor, Institute for Biophysical Dynamics, James Franck Institute, The University of Chicago	Ph.D., Applied Physics from Harvard University	Astellia USA Foundation Award (2009) Fellow of the American Physical Society (2009)	16-19 Sep, 2014	Participation in the 1 <sup>st</sup> UChicago/AIMR Joint Research Center Workshop and giving a talk
NEALEY PAUL FRANKLIN	Professor, The Institute for Molecular Engineering, The University of Chicago	Ph.D., Chemical Engineering from Massachusetts Institute of Technology	AIChE Nanoscale Science and Engineering Forum Award (2010) Fellow-American Physical Society (2009) Semiconductor Research Corporation Inventor Recognition Award (2009)	16-19 Sep, 2014	Participation in the 1 <sup>st</sup> UChicago/AIMR Joint Research Center Workshop and giving a talk
AWSCHALOM DAVID DANIEL	Professor, The Institute for Molecular Engineering, The University of Chicago	Ph.D., Physics from Cornell University	Julius Edgar Lilienfeld Prize from the American Physical Society (2015) David Turnbull Award from the Materials Research Society (2010) UC Faculty Research Lecturer Award (2008)	16-19 Sep, 2014	Participation in the 1 <sup>st</sup> UChicago/AIMR Joint Research Center Workshop and giving a talk
CLELAND ANDREW	Professor, The Institute for Molecular Engineering, The University of Chicago	Ph.D., Physics from University of California, Berkeley	Fellow, American Association for the Advancement of Science Fellow, American Physical Society Breakthrough of the year from AAAS Science magazine (2010) Top Ten Discoveries from Physics World (IOP) (2011) Top Ten Discoveries from Physics World (IOP) (2010)	16-19 Sep, 2014	Participation in the 1 <sup>st</sup> UChicago/AIMR Joint Research Center Workshop and giving a talk
DE PABLO JUAN JOSE	Professor, The Institute for Molecular Engineering, The University of Chicago	Ph.D., Physics from University of California, Berkeley	Fellow, American Academy of Arts and Sciences (2011) Charles Stine Award, American Institute of Chemical Engineering (2011) Stauder-Durer Medal, ETG-Zurich (2013) Fellow, Mexican Academy of Sciences (2013)	16-19 Sep, 2014	Participation in the 1 <sup>st</sup> UChicago/AIMR Joint Research Center Workshop and giving a talk

GALLI GIULIA	Liew Family Professor, The Institute for Molecular Engineering, The University of Chicago	Ph.D., Physics from The International School of Advanced Studies (SISSA), Trieste, Italy	AAAS Fellow (2013) APS Fellow (2004) Elected APS-DCOMP Chair (2006) Science and Technology LLNL Award (2004)	16-19 Sep, 2014	Participation in the 1 <sup>st</sup> UChicago/AIMR Joint Research Center Workshop and giving a talk
Jawwad Darr	Professor, University College London	Ph.D., Science Synthesis of Nanoparticles, Composites and Catalysts using Supercritical Fluids (SCFs)	EPSRC Advanced Fellowship Vice president of the Chemical and Physical Society, UCL Chemistry	17 Sep, 2014	Discussion on research
RAMALINGAM MURUGAN	Associate Professor, Centre for Stem Cell Research	Ph.D.	CSIR Fellowship (India) SMF Fellowship (Singapore) NRC National Academies Fellowship (USA) Nationale Professeur des Universités (France) Fellow of Royal Society of Chemistry (UK)	20-28 Sep, 2014 14-21 Feb, 2015	Stay for joint research as Adjunct Associate Professor
MYSEN BJORN OLAV	Senior Scientist, Geophysical Laboratory, Carnegie Institution of Washington	Ph.D.	George W. Morey Award, Amer. Ceram. Soc. (2006) Fellow, Mineralogical Society of America Geochemistry Fellow, Geochemical Society & European Association of Geochemistry (2008)	06 Oct – 21 Nov, 2014	Stay for joint research as Visiting Professor
WESTERVELT ROBERT MOORE	Mallinckrodt Professor of Applied Physics and Physics, Department of Physics, Harvard University	Ph.D., Quantum Behavior of Electrons inside Semiconductor Nanostructures	APS Fellow (2007)	14-16 Oct, 2014	Participation in RIEC/AIMR Special Seminar
YAVARI ALAIN REZA	Professor, Institut National Polytechnique de Grenoble	Ph.D., Metallic Glasses	ISMANAM Senior Scientist Award	25 Oct - 14 Nov, 2014 13 Feb - 05 Mar, 2015	Short-term stay for collaboration Research Participation in AIMR International Symposium 2015 (AMIS2015)
Bert Koopmans	Professor, Department of Applied Physics, Eindhoven University of Technology	Ph.D., Spintronics	NWO Vici Laureate (2004)	23 Oct, 2014	Discussion
RAJAN KRISHNA	Director, International Combinatorial Sciences and Materials Informatics Collaboratory, Iowa State University	Ph.D.	Akinc Research Award from Iowa State University (2009) NSF Scientific Visualization Competition Honorable Mention (2006) The Richard H. & Mary Jo Stanley Chair Professorship (2006)	01-05 Nov, 2014	Giving a talk at a seminar and discussion with Center Director

Jean-Paul Desaulniers	Associate Professor, University of Ontario Institute of Technology - Chemistry	Ph.D., Chemical biology	American Cancer Society Postdoctoral Fellowship	01 Nov - 30 Dec, 2014	Participation as JSPS Invitation Fellowship Program for Research
Thomas Baumgartner	Professor, University of Calgary	Ph.D., Synthesis and advanced characterization of phosphoorganic pi-conjugated materials for sustainable energy applications	Faculty of Science Award of Excellence in Research (2013)  Friedrich Wilhelm Bessel Research Award, Alexander von Humboldt Foundation (2013)  Japan Society for the Promotion of Science (JSPS) Invitation Fellowship (short term) (2011)  Alberta Ingenuity New Faculty Award (2007-2010)  Liebig-Fellow of the 'Fonds der Chemischen Industrie' (German Chemical Industry Association) (2002-2005)	09-10 Nov, 2014	Invited lecture in Department of Chemistry Discussions with researchers
ZHANG DI	Professor, Shanghai Jiao Tong University	Ph.D., Engineering	The second prize of Shanghai Municipal Teaching Achievement Award, China (2013) Incubation Award by the Shanghai Municipal Education Commission, China (2012)	19 Jan - 18 Feb, 2015	Stay for joint research as Visiting Professor
YAN XINGBIN	Associate Director, Lanzhou Institute of Chemical Physics, Chinese Academy of Sciences	Ph.D.	Singapore IES Prestigious Engineering Achievement Award (2007) Marie Curie Incoming International Fellowship, Commission of the European Communities (2006-2008)	19 Jan - 08 Feb, 2015	Joining Sakura Exchange Program in Science by JST
Wang Deyu	Professor, Associate Dean of School of Mechanical Engineering, Shanghai Jiao Tong University	Ph.D., Science		08-09 Feb, 2015	Short-term stay for joint research

EGAMI TAKESHI	Director, Joint-Institute for Neutron Sciences, UT-ORNL Distinguished Scientist/Professor, University of Tennessee at Knoxville and Oak Ridge National Laboratory	Ph.D., Materials Science from University of Pennsylvania	J. D. Hanawalt Award, International Union of Crystallography (2010) Senior Researcher Prize, International Symposium on Metastable and Nano Materials (ISMAM) (2006) Bertram Eugen Warren Diffraction Physics Award, Amer. Crystallographic Association (2003)	10-19 Feb, 2015	Short-term stay for joint research as Adjunct Professor of AIMR  Participation in Metallic Glass Workshop  Giving a talk at AIMR International Symposium 2015 (AMIS2015)
WANG ZHENGHAN	Principle Researcher, Microsoft Research  Professor, University of California, Santa Barbara	Ph.D., Mathematics from University of California at San Diego	NSF CISE/EIA 0130388, Project Director (2001-2006) NSF DMS/FRG 0354772, Project Director (2004-2010) NSF DMS 1108736, Project Director (since 2012)	10-28 Feb, 2015	Short-term stay for joint research Giving a talk at AIMR International Symposium 2015 (AMIS2015)
EDWARD CRAWLEY	Skolkovo Institute of Science and Technology (Skoltech) President, Professor	Sc.D. in aerospace structures from MIT	Fellow of the AIAA (American Institute of Aeronautics and Astronautics) Fellow of the Royal Aeronautical Society (UK) Member of the Royal Swedish Academy of Engineering Science, the Royal Academy of Engineering (UK) Member of the Chinese Academy of Engineering Member of the National Academy of Engineering (US)	11 Feb, 2015	Discussion on future research collaboration
MIKHAIL G. MYAGKOV	Vice-President for Academic Affairs and International Relations of Skoltech, Professor	Ph.D., Applied Mathematics from the California Institute of Technology	Founder of Mobile Planetariums, a Moscow based company that has become a leader in promoting astronomy education in Russia Serving on the Advisory Board of Canadian based Epiphany Systems – the international leader in image capturing equipment, and Moscow based Evanty Inc. – one of the leading providers of satellite internet in Russia	11 Feb, 2015	Discussion on future research collaboration

Gianola Daniel Santiago	Skirkanich Assistant Professor, University of Pennsylvania	Ph.D., Mechanical Engineering	The Minerals, Metals and Materials Society(TMS) Early Career Faculty Fellow Award(2013)	11-21 Feb, 2015	Short-term stay for joint research, participation in Metallic Glass Workshop and AIMR International Symposium 2015 (AMIS2015)
GUAN PENGFEI	Assistant Professor, Beijing Computational Science Research Center	Ph.D., Materials Physics and Chemistry, Central Iron & Steel Res. Inst.(CISRI), Beijing	China Young 1000-Talent program (2014)	13-17 Feb, 2015	Short-term stay for joint research, participation in Metallic Glass Workshop and AIMR International Symposium 2015 (AMIS2015)
WANG XIJIE	Accelerator Directorate, SLAC National Accelerator Laboratory	Ph.D., Science from University of California, Los Angeles		13-17 Feb, 2015	Short-term stay for joint research, participation in Metallic Glass Workshop and AIMR International Symposium 2015 (AMIS2015)
YUE YUANZHENG	Professor, Aalborg University	Ph.D. from Technical University of Berlin, Germany(1995)	Council Member of the International Commission on Glass (ICG) Member of Danish Ceramic Society Member of American Ceramic Society Member of German Society of Glass Technology Member of British Society of Glass Technology	13-18 Feb, 2015	Short-term stay for joint research, participation in Metallic Glass Workshop and AIMR International Symposium 2015 (AMIS2015)
SUSHKO PETER	Associate Director, FCSD-Materials Sciences, Pacific Northwest National Laboratory	Ph.D. from University College London		14-19 Feb, 2015	Participation in AIMR International Symposium 2015 (AMIS2015) as Adjunct Associate Professor
ZIENERT ANDREAS	Postdoctoral Research Associate, TU Chemnitz and Fraunhofer ENAS	Ph.D., Electrotechnical Engineering from Technische Universität Chemnitz	Edgar-Heinemann Prize (2013)	14-20 Feb, 2015	Giving a talk at AIMR International Symposium 2015 (AMIS2015)
HALDANE FREDERICK DUNCAN MICHAEL	Eugene Higgins Professor of Physics, Princeton University	Ph.D., Physics, Condensed Matter theory	Alfred P. Sloan Foundation Research Fellow Fellow of the APS Fellow of the American Academy of Arts and Sciences Buckley Prize of the APS Fellow of the Royal Society of London Fellow of the Institute of Physics (UK) Fellow of the American Association for the Advancement of Science Lorentz Chair at the	14-20 Feb, 2015	Giving a talk at AIMR International Symposium 2015 (AMIS2015)

			Lorentz Institute, Leiden ICTP Dirac Medal (2012) Simons Fellow in Theoretical Physics		
Dr BEDNORZ JOHANNES GEORG	Fellow Emeritus IBM Research – Zürich	Dr. sc. Nat., Dr. h. c. mult.	Nobel Prize in Physics (1987)	14-20 Feb, 2015 15-19 Mar, 2015	Participation in AIMR International Symposium 2015 (AMIS2015) Participation in AIMR International Advisory Board Meeting
FINEL ALPHONSE	Director of the Laboratory of Microstructures Studies (ONERA/CNRS, France)	Ph.D., Physics	Sainte-Claire Deville Medal (2011)	14-20 Feb, 2015	Giving a talk at AIMR International Symposium 2015 (AMIS2015)
HEREMANS JOSEPH PIERRE	Ohio Eminent Scholar and Professor, The Ohio State University	Ph.D., Applied Physics from Catholic University of Louvain	Member of National Academy of Engineering Fellow of American Association for the Advancement of Science Fellow of American Physical Society (APS)	14-20 Feb, 2015	Giving a talk at AIMR International Symposium 2015 (AMIS2015)A
KELTON KENNETH FRANKLIN	Professor, Washington University at St. Louis	Ph.D. from Harvard University	ISMANAM Senior Scientist Award (2010) Hall of Distinction, Arkansas Tech University (2008) Elected Fellow of the American Physical Society (2005)	14-20 Feb, 2015	Giving a talk at AIMR International Symposium 2015 (AMIS2015)
LESTER EDWARD	Professor, The University of Nottingham	Ph.D., Chemical Engineering from The University of Nottingham	Winner of The Roy-Somiya Medal (2013) Winner of Lord Stafford Award (2009) Innovation Achieved	14-20 Feb, 2015	Giving a talk at AIMR International Symposium 2015 (AMIS2015)
STORY TOMASZ	Professor, Polish Academy of Sciences	Ph.D. from Polish Academy of Sciences	The W. Rubinowicz Scientific Award of the Polish Physical Society (1993)	14-20 Feb, 2015	Giving a talk at AIMR International Symposium 2015 (AMIS2015)
TOSATTI ERIO	ERC Principal Investigator and Prof. Emeritus of SISSA	Ph.D., Theoretical Physics from Scuola Normale Superiore, Pisa	Member, Accademia di Brera, Milan (2012) Foreign Associate, U. S. National Academy of Sciences, Washington D. C. (2011) Corresponding Member, Accademia Anzianale del Lincei, Rome (2006)	14-20 Feb, 2015	Giving a talk at AIMR International Symposium 2015 (AMIS2015)
PICKARD CHRISTOPHER JAMES	Professor, University College London	Ph.D. from University of Cambridge		15-19 Feb, 2015	Giving a talk at AIMR International Symposium 2015 (AMIS2015)

HILLEBRANDS BURKARD	Full Professor (W3), TU Kaiserslautern	Ph.D., Physics from RWTH Aachen University	Member of the Academy of Science and Literature, Mainz (since 2010) Fellow of the Institute of Electrical and Electronics Engineers (IEEE) (since 2010) Fellow of the American Physical Society (since 2010)	15-19 Feb, 2015	Giving a talk at AIMR International Symposium 2015 (AMIS2015)
BERRY MICHAEL	Professor of Physics (Emeritus), University of Bristol	Ph.D., Theoretical Physics from St Andrews	13 Honorary doctorates, membership of five international academies, Maxwell Medal (IoP, UK) Lilienfeld Prize (AIP) Dirac Medal and Prize (IoP, UK) Royal Medal (Royal Society) Naylor Prize (London Math. Soc.) Science for Art Prize (Louis Vuitton) Europhysics Prize (HP) etc.	15-19 Feb, 2015	Giving a talk at AIMR International Symposium 2015 (AMIS2015)
DAS SARMA SANKAR	Richard E. Prange Chair in Physics; Distinguished University Professor and Director of Condensed Matter Theory Center, University of Maryland	Ph.D., Physics from Brown University	ISI-Highly-Cited Researcher (2001) Thomson-Reuters Highly Cited Researcher (2014)	15-19 Feb, 2015	Giving a talk at AIMR International Symposium 2015 (AMIS2015)
SINGH DAVID JOSEPH	Corporate Fellow and Leader, Advanced Materials Group, Oak Ridge National Laboratory	Ph.D., Physics from University of Ottawa	Thompson-Reuters Highly Cited Researcher (2014) Fellow of the American Physical Society Gordon Battelle Prize (2011) ORNL Directors Awards (2008, 2009) E.O. Hulburt Science Award (2003)	15-20 Feb, 2015	Giving a talk at AIMR International Symposium 2015 (AMIS2015)
HYDE STEPHEN TIMOTHY	Professor, Australian National University	Ph.D. from Monash University	Barry Ninham Chair of Natural Science, Applied Mathematics Fellow, Australian Academy of Science (2005) Federation Fellow, Australian Research Council (2004)	15-20 Feb, 2015	Giving a talk at AIMR International Symposium 2015 (AMIS2015)

KIVELSON STEVEN ALLAN	Prabu Goel Family Professor of Physics, Stanford University	Ph.D. from Harvard University	Humboldt Research Award (2014) Fellow of the American Physical Society, John Bardeen Prize (2012) Member of the National Academy of Sciences (2010)	15-20 Feb, 2015	Giving a talk at AIMR International Symposium 2015 (AMIS2015)
EDELSBRINNE R HERBERT	Professor, IST Austria	Ph.D., Technical Mathematics	Alan T. Waterman Award from the National Science Foundation (1991) Member of the American Academy of Arts and Sciences (2005) Honorary Doctorate from the Graz University of Technology (2006) Member of the German Academy of Science (Leopoldina) (2008) Member of the Austrian Academy of Science (2012)	15-24 Feb, 2015	Giving a talk at AIMR International Symposium 2015 (AMIS2015)  Giving a talk at Topological Data Analysis on Materials Science workshop
AUGUSTINUS JOSEPHUS HELENA RIJNDERS	Professor and Principal Investigator, University of Twente	Ph.D., Physics from University of Twente	VIDI Award (2006) The FOM Valorisation Prize (2014)	16-20 Feb, 2015	Giving a talk at AIMR International Symposium 2015 (AMIS2015)
Konstantin Mischaikow	Professor, Rutgers University	Ph.D., Computational Topology and Dynamics from University of Wisconsin-Madison	Frame Teaching Award, Dept. of Math., Michigan State University (1989) C.I.M.E. Lecturer, Montecatini Terme (1994) AMS Invited Address, AMS Regional Meeting, Charlotte N.C. (1999) Best Paper Award: Trans. Japanese SIAM with Y. Hiraoka and T. Ogawa (2003) AMS Invited Address, AMS Sectional Meeting, Newark, NJ (2010)	18-22 Feb, 2015	Giving a talk at Topological Data Analysis on Materials Science workshop
Mathias Klaui	Full Professorship at the Johannes Gutenberg-Universität Mainz  Director of the Graduate School of Excellence: Materials Science in Mainz	Ph.D., Physics from the University of Cambridge	Nicholas Kurti Prize for Research in Physical Sciences, etc	21 Feb, 2015	Discussion
Stephane SARRADE	Head of Physical Chemistry Department, French Atomic Energy Commission	Ph.D., Chemical Engineering Chemical Engineering and Material Sciences	Sciences and Education Achievement by French Government (2007)	24 Feb, 2015	Discussion on research



Jyoti Ranjan Mohanty	Assistant Professor, Department of Physics, Indian Institute of Technology	Dr., Spintronics	German Physical Society, DPG member American Physical Society(APS) member Neutron Scattering Society of America (NSSA) member Magnetic Society of India (MSI) Life member	25 Feb, 2015	Discussion
Xu Bingshe	Vice President Taiyuan University of Technology	Doctor's degree, Engineering	Scientific and technological progress by the province successively (1999, 2002 and 2004)	26-27 Feb, 2015	Short-term stay for joint research
MALLAH TALAL	Professor of University Paris-Sud 11	Ph.D., Chemistry from University Paris-Sud 11		28 Feb - 30 Mar, 2015	Stay for joint research as Visiting Professor
Jishan Wu	Associate professor, National University of Singapore • Department of Chemistry	Ph.D., Materials Chemistry, Organic Chemistry and Polymer Chemistry from Max-Planck Institute for Polymer Research	Singapore National Young Scientist Award (2010) BASF-Singapore National Institute of Chemistry Award in Materials Science (2012) Invited Lecturer of Asian Excellence from the Japanese Society of Polymer Science (2012) Distinguished Lectureship Award from the Chemical Society of Japan (2013) NUS Outstanding Chemist Award (2013)	04-05 Mar, 2015	Invited lecture in Department of Chemistry Discussion about collaborative research
GOLDEN MARK	Professor of Physics, van der Waals- Zeeman Institute, Institute of Physics, University of Amsterdam, The Netherlands	Ph.D., Condensed Matter Physics	co-author of over 130 publications in international, refereed journals more than 110 invited talks at international conferences, workshops and at scientific colloquia	11-13 Mar, 2015	Short-term stay for discussion and joint research on molecular superconductors
BOUWKNEGT PIER GERARD	Professor, The Australian National University	Ph.D.	Australian Mathematical Society Medal (2001)	15-28 Mar, 2015	Discussion on research and participation a seminar
VARGHESE MATHAI	Elder Professor of Mathematics, University of Adelaide	Ph.D.	Fellow of the Australian Academy of Science (2013) Australian Mathematical Society Medal (2000)	15-28 Mar, 2015	Discussion on research and participation a seminar

NARAYANAMU RTI VENKATESH	Professor, Harvard University (Former Dean of School of Engineering and Applied Sciences)	Ph.D., Physics from Cornell University	Elected member of the National Academy of Engineering, the Royal Swedish Academy of Engineering Sciences, and the American Academy of Arts and Sciences	16-19 Mar, 2015	Participation in AIMR International Advisory Board Meeting
EI-ICHI NEGISHI	H. C. Brown Distinguished Professor of Chemistry, Purdue University	Ph.D., Organic Chemistry	Nobel Prize in Chemistry (2010)	16-20 Mar, 2015	Participation in AIMR International Advisory Board Meeting
CAREY ALAN LAWRENCE	Professor, The Australian National University	Ph.D.		17-31 Mar, 2015	Discussion on research and participation a seminar

## State of Outreach Activities

- Using the table below, show the achievements of the Center's outreach activities in FY2014(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 FY2014 resulting from press releases and reporting.

Activities	FY2014(number of activities, times held)
PR brochure, pamphlet	19
Lectures, seminars for general public	30
Teaching, experiments, training for elementary and secondary school students	11
Science cafe	3
Open houses	1
Participating, exhibiting in events	12
Press releases	25

### Special Achievements

In FY2014, the PR & Outreach Office of AIMR made great efforts to increase the publicity of AIMR through AIMR's website, the public magazine "AIMR Magazine" (volumes 5, 6, and 7), and a number of events. The office also made an effort to help researchers to issue press releases, and publicize excellent works achieved by AIMR researchers in newspapers and other media (see also Appendix 7). The following are special items carried out or started in FY2014.

**Outreach lecture by Prof. Shechtman:** The 2011 Nobel Chemistry laureate, Prof. Daniel Shechtman (Israel Institute of Technology), gave a special lecture entitled "Quasi-Periodic Crystals – A Paradigm Shift in Crystallography" at Tohoku University Centennial Hall (Kawauchi Hagi Hall) on May 13, 2014. This lecture was jointly sponsored by AIMR and the Interdepartmental Doctoral Degree Program for Multi-dimensional Materials Science Leaders (MD Program), Tohoku University. About 400 high school students from SSH high schools in Sendai City as well as about 100 participants from Tohoku University listened to his talk in English. After the lecture, some questions were asked by the high school students.

**Facebook:** We created a Facebook page for AIMR and started full-scale operation in April 2014. Through this page, AIMR is releasing real-time information on, for example, seminars, presentations at Friday Tea Time, and notable results achieved by the AIMR researchers, to the public.

**Activities with SSH:** As well as the Nobel laureate lecture described above, AIMR held international exchange meetings in which students from SSH and core-SSH-related high schools listened to a lecture in English and conversed with foreign researchers at AIMR. This event, which has been held since 2012, provides a good opportunity to use practical English for high school students without going abroad and plays an important role in motivating students highly for globalization.

## FY 2014 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	2015/2/25	Nikkan Kogyo Shimbun	An article entitled "Successful Characterization of the Two Superhard Materials" reported that the hetero-interface of diamond and cubic boron nitride was observed to form a honeycomb structure that could show a quasi-one-dimensional electrical conductivity. (Ikuhara)
2	2015/2/20	Nikkei Electronics	All solid-state Lithium-Sulfur (Li-S) batteries developed at their laboratory were shown with photographs. (Orimo, Unemoto)
3	2015/2/18	Kahoku Shimpo	Article about the lecture given by Prof. Nishiura at Tohoku University Science Cafe "Can mathematics rescue a crisis of the human life or death?" (Nishiura)
4	2015/1/20	Nikkei Sangyo Shimbun	University Analysis, Forest of Practical Science, World's Cutting-edge Technologies (Ohno)
5	2014/12/29 2015/1/23	Nikkan Kogyo Shimbun Science News (Kagaku Shimbun)	Unravelling of the fundamental electronic structure of silicene (Takahashi, Hitosugi)
6	2014/12/12	Dream Navi net (Education magazine issued by Yotsuya Otsuka Inc.)	On the pages where famous people from various fields are asked how to achieve ones dream, Director Kotani told her dream to solve various mysteries by mathematics and utilize them for society. (Kotani)
7	2014/12/12	Science News (Kagaku Shimbun)	Anomalous superconducting states in FeSe, in collaboration (Takahashi, Tanigaki)
8	2014/12/12	Nikkei Sangyo Shimbun	Elucidation of the behavior of electrons in metal oxide substrates such as strontium titanate (Hitosugi)
9	2014/12/9	Nikkei	Storage batteries toward the next generation (Orimo)
10	2014/12/8	Nikkei Sangyo Shimbun	Tohoku Univ. Supercritical Water as a catalyst (Adschiri)

11	2014/11/25	Nikkan Kogyo Shimbun	Development of magnetic sensors using amorphous alloy nanowires
	2014/12/2	Nikkei Sangyo Shimbun	Success in detection of small magnetism using a metallic nanowire whose thickness is of 1/100 of a hair. Applicable to diagnosis of heart/brain diseases. (Louzguine, Nakayama)
12	2014/11/20	Yahoo News	Development of nano electrochemical microscopy which achieves a chemical mapping (Matsue)
13	2014/10/8	Nikkei Sangyo Shimbun	Research results of Isobe lab on the development of the index for geometric measurement of nanotube molecules were introduced in the article titled of "Japanese Innovator; Advanced technology" (Isobe)
14	2014/10/7, 8	Nikkei Sangyo Shimbun	A feature article appeared for 2 days about the application of mathematics to materials science which Director Kotani is leading. (Kotani)
15	2014/9/18	Nikkei	Technology transfer to smaller companies led by Tohoku University. Technologies for reduction of friction and reuse of rare metals. (Kurihara)
16	2014/9/5	Nikkan Kogyo Shimbun	Uniform arrangement, density of 10 times, Quantum dot LED, 3D structure formed by biotechnology, Wide wavelength band (Samukawa, Higo)
17	2014/7/11	Nikkei Sangyo Shimbun	The article explaining the applicability of advanced mathematics to other areas (Nishiura)
18	2014/6/22	Weekly magazine The 4.6 Billion Year Journey of Earth (Asahi Shimbun Publications Inc.)	The atomic level structure of the tooth of the shark elucidated by the combination of scanning transmission electron microscopy and first-principle calculation. Shown with electric microscope images. (Ikuhara)
19	2014/5/23	Kyoto Shimbun	Prof. Esashi received Tateishi Prize for his achievement in electronics. (Esashi)
20	2014/4/7	Yomiuri Shimbun	Yomiuri Techno Forum, 2014 Gold Medal Awards "Electric signal transmitted through Insulator" (Saitoh)
21	2014/4/8	Nikkei	High Quality Three-Dimensional Nanoporous Graphene (Chen, Ito)
	2014/4/8	Nikkei Sangyo Shimbun	