World Premier International Research Center Initiative (WPI)
Activities Report of the WPI Academy Center
(FY 2017 – FY 2019)

Host Institution	Tohoku University	Host Institution Head	Hideo Ohno
Research Center	Advanced Institute for Materials Research (AIMR)		
Center Director	Shin-ichi Orimo	Administrative Director	Nobuyuki Nishiyama

Common Instructions:
* Unless otherwise specified, prepare this report based on the current (31 March 2020) situation of your Center.
* Use yen (¥) when writing monetary amounts in the report. If an exchange rate is used to calculate the yen amount, give the rate.
* Prepare this report within 10 pages (excluding the appendices, and including "Summary of State of WPI Academy Center Progress" (within 2 pages)).

Summary of WPI Academy Center's Activities (write within **2 pages**)

Overall Image of the Center

The goal of AIMR is to create new materials with innovative functions through a novel method of atomic and molecular control, construct novel devices using new materials, and contribute to society by building a foundation for safe and rich life. In order to achieve this goal, AIMR stipulated its identity as "discovering common elements and universal principles among different materials and creating new materials science which can develop new materials based on predictions," and proposed an innovative research strategy to promote "mathematics-materials science collaboration" at an institutional level. Based on the scientific principles achieved through the **mathematics-materials science collaboration** under the strong leadership of Prof. Motoko Kotani who was appointed to the Center Director in 2012, AIMR strengthened international cooperation network with world-leading institutions, and now AIMR is recognized as a hub of international collaborations and brain circulation. In FY2017, the following fiscal year after the termination of the WPI grant support, AIMR was admitted to "**WPI Academy**," and has made maximum efforts to keep "**World Premier Status**" given by WPI Program Committee for AIMR as an evaluation result. In October 2019, **Prof. Shin-ichi Orimo**, a specialist of materials development and device fabrication, was appointed as AIMR's **new Center Director** and Prof. Hiroshi Suito, the group leader of Mathematical Science Group, was appointed as Deputy Director. They are making an effort to raise the mathematics-materials science collaboration to the next stage where we develop real materials which contribute to society through the implementation of "**Advanced Target Projects**."

Advancing Research of the Highest Global Level

Even after entering WPI Academy, AIMR researchers are continuing to publish papers with high impact. Although the total number of published papers has decreased with decreasing the number of researchers, the number of the papers which appeared in Nature, Science and their sister journals has not decreased compared to the WPI funding period. The percentages of international joint authorship also keep high values. Through **mathematics-materials science collaboration** which has been the greatest feature and research strategy of the center, AIMR is maintaining high level research and fusion of researchers in the center.

Facilitating Interdisciplinary Research Activities

In FY2011, AIMR set **Target Projects** to give researchers concrete images for mathematics-materials science collaboration and has continued to produce excellent results till FY2016. These Targets Projects succeeded in extracting hidden structures which had not been discovered by conventional characterization techniques, for example, local weakly-ordered structure hidden in random atomic arrangement in amorphous materials. However, when we apply such information to development of new materials, we need to convert the information obtained based on mathematics into the words of materials science. AIMR appointed **Prof. Shin-ichi Orimo as the new leader** to push AIMR into the new direction. Under the supervision by the new leader Prof. Orimo, AIMR researchers discussed the results obtained by the previous Target Projects and subtracted bottlenecks which seem to prevent the development of new

materials, and set three **Advanced Target Projects (ATPs)**. AIMR is currently promoting interdisciplinary fusion research through implementing these ATPs as the core projects.

Maintaining an International Research Environment

Twenty-four distinguished Principal Investigators (PIs) including nine foreign researchers are continuously united, keeping the world-leading research environment, and pursuing pioneering research even now. Although the percentage of foreign researchers is gradually decreasing with a decrease of young researchers, AIMR is keeping the value greater than 35% as of FY2019. AIMR is maintaining activities in international collaboration mainly based on the cooperation with 13 overseas partner institutions including three satellites. The typical activities through the overseas partner institutions are following two; promotion of international collaboration through JRCs and enhancement of global brain circulation utilizing programs such as GI^3 Laboratory. Fraunhofer Project Center established in AIMR has also contributed to maintaining the international research environment.

Making Organizational Reforms and their Ripple Effects

In June 2017, Tohoku University was named a **Designated National University**. To strengthen the research capabilities, Tohoku University established four **Core Research Clusters** which were **modeled after WPI Centers** characterized by the top-down management **cultivated by AIMR**, and AIMR has been placed as the core of **Core Research Cluster for Materials Science**, one of the four. This indicates that the know-how accumulated by WPI Program influenced the management system of the host institution. The team which supports all the activities maintaining international environment of AIMR is **International Affairs Center (IAC).** The functions of IAC cover a wide range of works; IAC support not only AIMR's internationalization but also the internationalization of entire university, for example, management support of joint laboratories which Tohoku University has established. These achievements clearly show that the experience and know-how which AIMR accumulated through the activities carried out in the ten years of WPI's support are currently giving considerable ripple effects and contributing to the development of the host institution, Tohoku University.

Effort to Enhance and Amplify the Visibility and Brand of the Overall WPI Program

As a WPI Center till FY2016 and as a WPI Academy Center after FY2017, AIMR has continuously published world-class research results and promoted "mathematics-materials science collaboration in the entire institute" which was unprecedented in the world, and as a result, AIMR succeeded in attracting attention of the researchers in materials science throughout the world. However, we understand that it is also important to gain attention of the researchers working in the field other than materials science and general citizens, and in order to let them know AIMR's activities, we also have made much effort in outreach activities. The specific examples of the activities performed in the last three years are (1) renewing outreach media, (2) cooperation with high schools and high school students, and (3) encouraging researcher’s press-release. Other than these activities, AIMR, together with members from other WPI Centers related to materials science (MANA, iCeMS, and I^2CNER), opened a booth and organized WPI workshops at European Materials Research Society (E-MRS) meetings, and also participated in the workshop on nanomaterials jointly organized with France (NanoMat). We believe that these efforts have surely improved the presence and visibility of WPI Program and each WPI Center.

Effort to Secure the Center’s Future Development over the Mid- to Long-term

The host institution, Tohoku University, is continuing to maintain the position of AIMR as a regular department, and provide AIMR with authority, resources and infrastructure even after the termination of the WPI funding period. Tohoku University was named a Designated National University in June 2017 and the university has established world-leading research centers (Core Research Clusters) for four research fields including materials science; AIMR is given the role to lead the materials science of Tohoku University as the core department of the Core Research Cluster for Materials Science. The significance to maintain and develop AIMR is not only aiming for the strengthening of research capabilities of Tohoku University but also aiming for reform of the conventional systems. AIMR has expanded the achievements of the system reform as a WPI center to the inside of the university. AIMR can contribute to in-house brain circulation using the tenured positions provided by the host institution. AIMR has showed models to increase of employment through attracting branches of other institutions and cross-appointment. AIMR has started new type of cooperation with industry, such as g-RIPS, which encourages future international brain circulation. All these leading activities improve the existence value of AIMR and secure the AIMR’s future development over the mid- to long-term.

* Describe clearly and concisely the progress being made by the Center from the viewpoints below.
- In addressing the below-listed 1-8 viewpoints, place emphasis on the following:
  (1) Whether research standards and operation of the Center is maintaining a “world premier” status.
  (2) Whether the Center participate and cooperate to the activities to advance the overall development of the WPI Program and to promulgate its achievements.

1. Overall Image of Your Center

・Describe the Center’s current identity and overall image.
・List the Principal Investigators in Appendix 2, diagram the Center’s management system in Appendix 3-1, enter the number of center personnel in Appendix 3-1a, and enter center funding in Appendix 3-2.

The goal of AIMR stipulated in the proposal for its foundation in FY2007 was to create new materials with innovative functions through a novel method of atomic and molecular control departing from traditional approaches, construct novel devices using new materials, and contribute to society by building a foundation for safe and rich life. In order to achieve this goal, AIMR stipulated its identity as “discovering common elements and universal principles among different materials and creating new materials science which can develop new materials based on predictions,” and proposed an innovative research strategy to promote “**mathematics-materials science collaboration**” at an institutional level. Based on the scientific principles achieved through the mathematics-materials science collaboration under the strong leadership of Prof. Motoko Kotani who was appointed to the Center Director in 2012, AIMR strengthened international cooperation network with world-leading institutions, and now AIMR is recognized as a hub of international collaborations and brain circulation. In FY2017, the following fiscal year after the termination of the WPI funding period, AIMR was admitted to "**WPI Academy**," and has made maximum efforts to keep "**World Premier Status**" given by WPI Program Committee for AIMR as an evaluation result. In October 2019, **Prof. Shin-ichi Orimo**, a specialist of materials development and device fabrication, was appointed as AIMR's **new Center Director** and Prof. Hiroshi Suito, the group leader of Mathematical Science Group, was appointed as Deputy Director. They are making an effort to raise the mathematics-materials science collaboration to the next stage where we develop real materials which contribute to society through the implementation of "**Advanced Target Projects**."

As of 31st March, 2020, 24 Principal Investigators (excluding two Junior Principal Investigators) listed in in **Appendix 2** are leading their laboratories. The management system of AIMR is shown as a diagram in **Appendix 3-1**. Currently, about 100 researchers and about 60 administrative/support staff members are working as shown in **Appendix 3-1a**, keeping about 2/3 of the scale of personnel (the number of members) compared to that during the WPI funding period. Total budget of AIMR including external research funds is 1.9-2.0 billion JPY per year as shown in **Appendix 3-2**.

2. Advancing Research of the Highest Global Level

・Describe what’s been accomplished in the Center’s research objectives and plans.
・In Appendix 1, list the papers underscoring those research achievement and list the Center’s research papers published in 2017-2019 in a manner prescribed in Appendix A.

Even after entering WPI Academy, AIMR researchers are continuing to publish papers with high impact (see the publication list in **Appendix A**). Although the total number of published papers has decreased with decreasing the number of researchers (250-300 papers a year at present while 350-400 papers a year during the WPI funding period), the number of the papers which appeared in Nature, Science and their sister journals (published 24, 14, 22 papers in 2017, 2018, and 2019, respectively) has not decreased compared to the period of the WPI grant support. With respect to the percentages of international joint authorship, high values have been kept as 53.4%, 59.0%, 61.8% for 2017, 2018, and 2019, respectively, and these values ensure that AIMR is actively continuing international joint research even after the termination of the WPI funding period.

AIMR's research is based on fundamental understanding of atoms and molecules which are the smallest elements of materials. Therefore, the research results can be categorized into the following four parts based on the size scale of phenomena, (1) fundamental understanding of atoms and molecules by direct observation of atoms and molecules, (2) controlling atoms and molecules based on the understanding, (3) creating new materials, and finally (4) developing new devices and systems using the new materials. This series of the processes corresponds to the size scale from micro to macro, and from basic research to applications. The specific results shown in **Appendix 1** are also arranged according to the order of size, from micro to macro. Achievements obtained based on **mathematics-materials science collaboration** which has been the greatest feature and research strategy of AIMR will be described in detail in the next section.

3. Facilitating Interdisciplinary Research Activities

- Describe the content of measures taken by the Center to facilitate interdisciplinary research activities. For example, measures that create an environment that will facilitate doing joint research by researchers in differing fields.
- Describe the contents and results of interdisciplinary research activities yielded by the measures described above.

The most important concept for interdisciplinary fusion at AIMR is **mathematics-materials science collaboration**. Mathematics can provide every kind of natural science with universal language and injection of mathematics in materials science to integrate wide range of materials science was some kind of symbol of the identity of AIMR. However, it was not clear for materials scientists and mathematicians how to apply mathematics to the problems in materials science. Therefore, in FY2011, AIMR set **Target Projects (TPs)** to give researchers concrete images for mathematics-materials science collaboration and has continued to produce excellent results till FY2016. First, three TPs,

[TP1] Non-equilibrium Materials based on Mathematical Dynamical Systems
[TP2] Topological Functional Materials
[TP3] Multi-Scale Hierarchical Materials based on Discrete Geometric Analysis

which related with mathematics were set, and later, fourth target project

[TP4] Core Technology for Nano Energy Devices

which utilizes new materials created based on the fundamental three TPs for developing new devices and contributes to society was added. These Targets Projects succeeded in extracting hidden structures which had not been discovered by conventional characterization techniques, for example, local weakly-ordered structure hidden in random atomic arrangement in amorphous materials. In 2015, during the WPI funding period, based on the trial and achievements of the mathematics-materials science collaboration, AIMR started the publication of **"SpringerBriefs in the Mathematics of Materials"** (Editor-in-chief: Motoko Kotani), the world's first monograph series for mathematics-materials science collaboration, and the publication is still ongoing even after the termination of the WPI grant. The following four books have been published so far:

Vol. 1: A New Direction in Mathematics for Materials Science (S. Ikeda and M. Kotani)
Vol. 2: Structural Analysis of Metallic Glasses with Computational Homology (A. Hirata, K. Matsue, and M.W. Chen)
Vol. 3: Bayesian Optimization for Materials Science (D. Packwood)
Vol. 4: Topology of Polymers (K. Shimokawa, K. Ishihara, and Y. Tezuka)
(We asked researchers outside of AIMR to write Vol. 4 to expand a range of this collaboration with mathematics.)

As stated above, AIMR is still placing "mathematics-materials science collaboration" as the main frame of AIMR's identity even after becoming one of the WPI Academy members, and its achievements are also included in **Appendix 1** which shows the representative papers published in the past three years.

However, AIMR's final goal is not only create new scientific principles but also to contribute to society through the development of new functional materials and devices based on the new scientific principles created at AIMR. When we wish to apply the achievement obtained through mathematics-materials science collaboration to the development of new materials, we need to convert the information obtained based on mathematics into the words of materials science. In order to realize this, we need to place a materials scientist who has substantial experience in developing new materials as a leader and reconstruct the system into a new one which can develop novel materials through incorporating new mathematical tools which are appropriate for materials design with the support of mathematicians. As the best leader to push AIMR into the new direction, **Prof. Shin-ichi Orimo** (joined AIMR as a Principal Investigator on January 1st, 2013, became Deputy Center Director on November 1st, 2018, and became Center Director on October 1st, 2019) was appointed **as the new Center Director**. Under the supervision by the new leader Prof. Orimo, AIMR researchers discussed the results obtained by the previous Target Projects (TP1-4) and subtracted bottlenecks which seemed to prevent the development of new materials, and set the following three **Advanced Target Projects (ATPs)**:

[ATP1] Local Structure Control in Topological Functional Materials
[ATP2] Integrated Control of Bond Variation and its Time Evolution
[ATP3] Improvement of Self-Organization Technology and Control of Biological Response

The essence of TP1, TP2, and TP3 have been inherited by ATP2, ATP1, and ATP3, respectively, and the

knowledge and technology accumulated by TP4 will be utilized in all the three ATPs, 1, 2, and 3. ATP1 newly introduces mathematical tools which can find new topological materials, while the achievement of the previous TP2 was limited to the clarification of the relationship between electronic structures and electric conduction of topological materials. ATP2 newly introduces mathematical tools which can deal with dynamic structures of ions, for examples, ions within batteries, while the static random structure of atomic arrangement was clarified in TP1. ATP3 makes it possible to control the response in living systems based on the knowledge accumulated in TP3 which focused on hierarchical structures of materials.

These three ATPs are explained by the new Center Director, Prof. Orimo, at the domestic meeting and international meeting of WPI Program Committee held on June 19th, 2019 and on November 19th, 2019, respectively. Some results have already been achieved, for example, in ATP2, dynamics of light elements in hydrogen materials has been clarified by the combination of molecular dynamics simulations and persistent homology.

AIMR started Fusion Research Proposal Program in FY2009 in order to support the interdisciplinary research based on various new ideas AIMR researchers proposed, and this program is recognized as one of the most important activities which characterize AIMR. Therefore, AIMR is continuing this program even after the termination of the WPI grant, and 15, 13, and 14 research proposals have been accepted in FY2017, FY2018, and FY2019, respectively. AIMR is still making much effort to nurture the growth of new fusion.

4. Maintaining an International Research Environment

- Describe what's been accomplished in the efforts to raise the Center's recognition as a genuine globally visible research institute, along with innovative efforts proactively being taken, including the following points, for example:
  - Efforts being developed to maintain an international research environment based on the analysis of number and state of world-leading, frontline 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 researchers from around the world (such as creating of an environment in which researchers can concentrate on their research, providing startup research funding, supporting efforts that will foster young researchers and contribute to advancing their career paths, and arranging support system for the research activities of overseas researchers.)
  - Consolidation of the administrative structures to support implementing the efforts described above
- In Appendix 3-1, describe the state of cooperation with overseas satellites, and list the main international research meetings held by the Center.

Twenty-four distinguished Principal Investigators (PIs) including nine foreign researchers listed in **Appendix 2** (the total number of PIs should be 26 if two Junior PIs who are not shown in this list are included in PIs) are continuously united, keeping the international research environment, and pursuing world-leading research even after the termination of the WPI funding period. For example, Prof. Yong P. Chen who was appointed to a PI of AIMR in April 2017 is one of the world leaders in topological materials research field. Although he is currently a full professor of Purdue University, the United States, he is concurrently holding a position as a PI of AIMR by cross-appointment and stays 2-3 month every year, working at Prof. Yong P. Chen Laboratory built in AIMR Main Building with young researchers of his group in AIMR.

Although the percentage of foreign researchers (it was around 50% till FY2016) is gradually decreasing with a decrease of young researchers, AIMR is keeping the value greater than 35% as of FY2019 (see **Appendix 3-1a**). AIMR is still sustaining the common equipment room, so that even short-stay visitors and researchers from overseas can start experiments almost immediately after arrival.

As shown in **Appendix 3**, AIMR is maintaining activities in international collaboration. AIMR has conducted joint research with 13 overseas partner institutions including three satellites. The typical activities with the overseas partner institutions are following two; promotion of international collaboration through Joint Research Centers and enhancement of global brain circulation utilizing programs such as GI^3 Laboratory:

(1) Promotion of international joint research through Joint Research Centers and others

AIMR established joint laboratories called **Joint Research Centers (JRCs)** at three satellites, the University of Cambridge, the University of Chicago, and Tsinghua University by signing the agreements, and is still operating these JRCs. The JRCs at the University of Cambridge and the University of Chicago were established during the WPI funding period and JRC at Tsinghua University was established in 2018. At each JRC, appropriate postdoctoral researchers are employed on site based on the careful discussion between AIMR and each satellite institution and carried out close collaboration which led to excellent

research achievements. As shown in **Appendix 3-1**, eleven papers have been published as the results of joint research with the satellite institutions in the past three years (2017-2019). AIMR has invited the postdoctoral researchers employed as JRC researchers to the international symposium held in Sendai every year in February and asked them to give poster presentations. AIMR, at its inside, has Fraunhofer Project Center established in cooperation with Fraunhofer Institute for Electronic Nano Systems (ENAS), Germany, and the exchange and collaboration through this center has largely contributed to maintaining the international research environment of AIMR.

(2) Enhancement of global brain circulation utilizing programs such as GI^3 Laboratory

AIMR is promoting researcher exchange between AIMR and overseas institutions and steadily making AIMR a hub of global brain circulation by operating original exchange programs, such as **GI^3 (Global Intellectual Incubation and Integration) Laboratory Program** and AIMR Overseas Dispatch Program for Young Researchers. GI^3 Laboratory Program enables us to invite researchers to invite overseas institutions, mainly from partner institutions, and Overseas Dispatch Program enables us to dispatch young researchers of AIMR to overseas institutions. The number of researchers used these programs are 9, 11, and 8 in FY2017, FY2018, and FY2019, respectively. These two programs have worked well to maintain the international research environment of AIMR.

Other important factors to maintain an international research environment of AIMR are listed below:

[IAC]

The team which supports all the activities for international cooperation at AIMR mentioned above is **International Affairs Center (IAC).** The functions of IAC cover a wide range of works, preparation for partnership agreement with overseas institutions, negotiation in advance and preparation of the agreement documents to establish JRCs with satellite institutions, operation of GI^3 Laboratory Program and AIMR Overseas Dispatch Program for Young Researchers (procedures for invitation and dispatch of researchers), planning of international symposia and invitation of the speakers, and so on. The IAC, which is a team consisting of the experts of international affairs, is one of the advantages of AIMR.

[Tea Time]

AIMR started Friday Tea Time in September 2009 to make place where all the AIMR members gather, meet and talk to other members, exchange information, and find new ideas for future collaboration. Tea Time also provides opportunities for researchers and sometimes administrative staff members to give talks, for example, short presentations reporting the results of fusion research, talks by world eminent researchers called "Tea Time Talk," and some announcements from administrative office. Tea time is usually held at the Combination Room on the fifth floor of the AIMR Main Building, and an open and relaxed atmosphere which Tea Time provides is surely contributing to making international research environment in AIMR. In June 2019, AIMR started another kind of tea meeting in which Center Director and young researchers exchange information under a relaxed atmosphere.

5. Making Organizational Reforms and their Ripple Effects

- Describe distinctive effort in managing research operation and administrative organization, such as the strong leadership that the director is giving on the Center's operation, strong performance by the administrative director who provides the center director with strong administrative and managerial support, and division of roles and authority between the Center and its host institution.
- Describe the ripple effects that activities to disseminate experience and know-how accumulated by the Center, such as the followings, have/had on the host institution (or other research institutes, if any):
  - System reforms made through the Center's leading activities to its research operation and administrative organization
  - Experience and know-how accumulated by the Center as it have worked to establish itself as top world-level research institutes.
- Other than the above, give examples, if any, of cooperative activities by the Center and the whole WPI Program or other WPI centers, to disseminate experience and know-how accumulated by the WPI program and/or the WPI centers.

In June 2017, Tohoku University was named a **Designated National University** by Minister of Education、Culture、Sports、Science and Technology. At that time, Tohoku University promised, as a strategy to strengthen the research capabilities of the university, that Tohoku University would initiate **world-leading research centers** (named as **"Core Research Cluster"**) of the four fields which were already considered strong at Tohoku University, (1) Materials Science, (2) Spintronics, (3) Next-Generation Medical Care, and (4) Disaster Science, and place them in **Organization for Advanced Studies (OAS)**. As shown in Diagram of Management System (Center's position within the host institution) in **Appendix 3-1**, AIMR had been under the umbrella of OAS since the establishment of OAS in FY2014, and the above four Core Research Clusters have been placed at the same level as AIMR. The **(1) Core Research Cluster**

for Materials Science consists of materials scientists who belong to AIMR, IMR (Kin-ken), IMRAM (Tagen-ken), School of Engineering, or School of Science, and AIMR acts as the core and coordinating department of this Core Research Cluster for Materials Science. The above four Core Research Clusters were **modeled after WPI Centers** characterized by the top-down management **cultivated by AIMR**, and this indicates that the know-how accumulated by WPI Program influenced the management system of the host institution.

With the support by the Japanese government, in these days, University Research Administrators (URAs) are placed at departments as well as university headquarters and the importance of URAs has been recognized. However, when WPI Program started, there were no staff members called URA, and appointment of **Administrative Directors** at the administrative offices of WPI Centers (AIMR also placed Deputy Administrative Director for research) was very advanced effort in Japan at that time. This effort aimed to reform a research support system according to the viewpoint of researchers, and it can also be said that this effort paved the way for the activities of URAs and URA-like staff members today, and know-how of WPI gave ripple effects to the system of Japanese universities.

The **IAC** described in the preceding section organized the annual international symposia of AIMR (The AIMR International Symposium; AMIS) and led us to success every year during the WPI funding period (till FY2016). After FY2017, namely, after the initiation of the Core Research Cluster for Materials Science, IAC has organized the joint international symposia held with Core Research Cluster for Spintronics three times, Kick-off Symposium for World Leading Research Centers -Materials Science and Spintronics- (Feb. 2018), The 2nd Symposium for World Leading Research Centers -Materials Science and Spintronics- (Feb. 2019), and The 3rd Symposium for The Core Research Clusters for Materials Science and Spintronics (Feb. 2020) by utilizing the experience and know-how accumulated through WPI activities. Furthermore, IAC is not only acting as the international affairs section of AIMR but also acting as the international affairs section of OAS directly attached to the university headquarters. By utilizing the experience and know-how accumulated through the establishment of AIMR Joint Research Centers at the overseas satellite institutions, IAC's staff are supporting the initiation and management of ELyTMaX, the joint laboratory between INSA-Lyon and Tohoku University sponsored by CNRS, and also supporting the initiation and management of Liaison Office established for the international collaboration between National Chiao Tung University (Taiwan) and Tohoku University.

These achievements clearly show that the experience and know-how which AIMR accumulated through the activities carried out in the past ten years as a WPI Center are currently giving considerable ripple effects and contributing to the development of the host institution, Tohoku University.

6. Effort to Enhance and Amplify the Visibility and Brand of the Overall WPI Program

- Describe how the Center's outreach activities have contributed to enhancing and amplifying the visibility and brand of the WPI program. Describe the successful cases of the Center's outreach activities in Appendix 4, and enter the number of activities in Appendix 4a.
- Other than the above, describe, if any, the activities and their concrete contents that have contributed to the enhancement and amplification of the visibility and brand of the WPI program (such as holding a large international research meeting, collaborative activities with multiple WPI centers). If you have already provided this information, please indicate where in the report.

As a WPI Center till FY2016 and as a WPI Academy Center after FY2017, AIMR has continuously published world-class research results and promoted "mathematics-materials science collaboration in the entire institute" which was unprecedented in the world. These efforts are surely effective in attracting attention of the researchers in materials science throughout the world. However, we understand that it is also important to gain attention of the researchers working in the field other than materials science and general citizens, and in order to let them know AIMR's activities, we have made much effort in **outreach activities**. As described in **Appendix 4**, we performed the following three as distinctive activities after FY 2017.

(1) Renewing outreach media

At the timing of the change of Center Director to Prof. Shin-ichi Orimo in October 2019, we renewed AIMR's website, pamphlets, public relations magazines and the promotion video to make them more attractive. The renewal of these outreach media is working well, for example, the browsing frequency of the website increased after the renewal. AIMR also newly launched "AIMR Supporters" and "AIMR Alumni Network" after entering WPI Academy to build a network of the people who support the activities of AIMR.

(2) Cooperation with high schools and high school students

Until FY2016, the PR & Outreach Office of AIMR built up a good relationship with some high schools

assigned to Super Science Highschool (SSH) and has given scientific advice and made opportunities for high school students to communicate with researchers and students from overseas in English on a regular basis. In FY2017, National Culture Festival for Upper Secondary Schools (Soubun) was held in Miyagi-prefecture (Miyagi-soubun 2017), and based on the request from the high school side, about 40 people, students and some teachers, visited AIMR and AIMR provided them with opportunities of mini practical training at three laboratories. Furthermore, AIMR provided groups of high school students from Japan and the U.K. participating in "The 2018 Tohoku UK-Japan Young Scientists Workshop" with a chance to have some experiments and exchange between the U.K. and Japan.

(3) Encouraging researcher's press-release
PR & Outreach Office of AIMR encouraged press-release especially for young researchers. This effort has led not only to the increase of the number of releases but also to the increase of research funds provided by companies.

Other than these activities, together with members from other WPI Centers related to materials science (MANA, iCeMS, and I^2CNER), AIMR opened a booth and organized WPI workshops at European Materials Research Society (E-MRS) meetings, and also jointly participated in NanoMat, Japan-France workshop on Nanomaterials and (concurrently) the WPI workshop on Materials science (held in Fukuoka in 2017 and Paris in 2019) as listed in Appendix 3-1. We believe that these efforts surely improved the presence and visibility of WPI Program and each WPI Center.

7. Effort to Secure the Center's Future Development over the Mid- to Long-term

・Address each of the following items that have been done to secure mid- to long-term center development:
- Contents of the measures taken by the host institution to support maintaining the activities of the Center (such as securing financial and personnel resources, coordination among host institution to bring together in-house researchers, in-kind provision and/or facilities afforded in terms of usage of building, lab space and other equipment, new management reform carried out after the funding period ends).
- Actions and measures taken to sustain the Center as a world premier international research center.

The position and role of AIMR in the host institution and specific measures implemented to maintain AIMR are listed below.

(1) Host institution's policy on support to sustain AIMR

The host institution, Tohoku University, is continuing to maintain the position of AIMR as a regular department of the university, and providing AIMR with authority, resources and infrastructure even after the termination of the WPI funding period. It can be seen in the statements of Tohoku University's "Third Mid-term plan" that steady strengthening of AIMR and construction/expansion of world-leading research environment and research support system are among the university's goals. It is also expressed that Tohoku University will keep AIMR as the core to achieve the university's goals, "establishing world-leading research institutes" and "jumping to world class as the hub of global brain circulation" stipulated in SATOMI VISION (which is followed by Tohoku University Vision 2030 established by the current President Dr. Hideo Ohno), by putting AIMR in "Organization for Advanced Studies (OAS)," the special ward for research. Tohoku University was named a Designated National University by the Japanese Government in June 2017 and the university has established world-leading research centers (Core Research Clusters) for four research fields including materials science; AIMR is leading the materials science of Tohoku University as the core department of the Core Research Cluster for Materials Science.

(2) Expansion of the system reform tackled as a WPI center in the university

The host institution, Tohoku University, established OAS as the special ward for research comprised of WPI-type centers in FY2014 in order to spread the expertise of internationalization and system reform which AIMR cultivated as a WPI center over the whole university. Research system and administration system grown at AIMR have also spread into fields other than materials science, and Tohoku University has placed Core Research Clusters for four research fields including materials science under OAS as WPI-type research centers. Tohoku University established International Affairs Center, IAC (developed from Research Reception Center of AIMR) and assigns this center to support the international open laboratories such as "ELyTMaX (Lyon-Tohoku joint laboratory supported by CNRS, France)" and Tohoku Forum for Creativity. Tohoku University is expecting AIMR to continue to make such effort, and this becomes the motivation for Tohoku University to maintain AIMR.

(3) Financial Measures by the host institution

President Satomi (Apr. 2012 - Mar. 2018) and President Ohno (Apr. 2018 -) pledged to keep permanent staff members (about ten tenure faculties and about ten administrative staff) already placed at AIMR, and add ten tenured positions. The five of the ten positions have been occupied by Professors Shigemi Mizukami (PI), Ayumi Hirano (PI), Hiroshi Suito (PI), Hayato Chiba (PI) and Associate Professor Hiroshi Yabu (tenure-track Junior PI). The other remaining positions are under consideration. AIMR started new international recruitment of a tenured PI/tenure-track Junior PI at the end of FY2018, and through the careful screening, AIMR made a decision to employ Dr. Tomoki Ozawa who was well-known as a young and energetic theoretical physicist in the field of topological materials. Dr. Ozawa joined AIMR in February 2020 as Junior PI (Associate Professor) and as the sixth member using the additional tenured positions. The financial resource from the host institution are used mainly to start the laboratories of such tenure positions and to keep young researchers and the administrative/support staff members. Part of the resource are used to maintain cooperative relationship with the overseas satellites.

The host institution, Tohoku University, established the OAS in FY2014 to maintain and develop the excellent research and organizational system which AIMR cultivated in the past ten years, and fixed AIMR as a regular department of Tohoku University. These activities were accepted as the relevant projects of the “National University Corporation Management Expenses Grants (to promote strengthening functions) 国立大学法人運営費交付金(機能強化促進分)” and “National University Corporation Grants for Promotion of Strengthening Functions 国立大学法人機能強化促進費” in FY2017 provided by the Japanese Government, which have been partially used for maintaining the activities of AIMR.

(4) Increase of employment through attracting branches of other institutions and cross-appointment

AIMR is making an effort to increase the opportunities to have collaboration by attracting cooperation branch offices of other institutions in AIMR and keep the number of researchers utilizing cross-appointment system. For example, AIMR attracted Open Innovation Laboratory (OIL) focusing on mathematical modeling of materials which National Institute of Advanced Industrial Science and Technology (AIST) planned to establish, and AIST-TohokuU Mathematics for Advanced Materials Open Innovation Laboratory (MathAM-OIL) was established in June 2016 in AIMR ANNEX Building. So far, four researchers of AIMR (professors and associate professors) have joined this MathAM-OIL by the cross appointment between AIST and Tohoku University, leading to maintaining the employment of AIMR researchers. The postdoctoral researchers of MathAM-OIL (more than ten) are joining the activities of AIMR as visiting researchers of AIMR and spectrum of interdisciplinary fusion research at AIMR is spreading wider. In FY2018, SUURI-COOL (Sendai), the cooperation branch office of Interdisciplinary Theoretical and Mathematical Sciences Program (iTHEMS) of RIKEN was established. One AIMR researcher (an assistant professor) is in the employ based on the cross-appointment between RIKEN and Tohoku University, also leading to maintaining the employment of AIMR researchers.

(5) Strengthening cooperation with industry

Based on the partnership agreement with IPAM (Institute for Pure & Applied Mathematics), University of California at Los Angeles (UCLA), in FY2018, AIMR started g-RIPS-Sendai (Graduate-Level Research in Industrial Projects for Students - Sendai), a Japan's version of RIPS (Research in Industrial Projects for Students) which IPAM has organized for more than ten years. This is one kind of an international internship program, and students coming from the United States and Japan jointly tackle the problems which sponsor companies provide and find ways to solve them. So far, this program has been provided project funds by Toyota Motor Corporation, Fujitsu Laboratories Limited, and NEC Corporation, and the program is useful also for strengthening the cooperation with industry. In order to encourage this activity, in FY2019, AIMR established Open Innovation Center for Mathematical Science (Head of the center is Prof. Hiroshi Suito, Deputy Director of AIMR) as the office to operate such programs. These efforts also secure the AIMR's future development over the mid- to long-term.

8. Others

- Describe the Center's efforts over the past 3 years in making it a place that expands and accelerates the international circulation of the world's best brains. Give about 5 example of their success cases and describe their concrete contents and effect in narrative.
- In addition to the above1-7, note any of the Center's notable efforts and activities.

The five examples of Center's efforts over the past 3 years which led to the expansion and acceleration of global brain circulation are listed below:

(1) Enhancement of global brain circulation through collaboration with satellite institutions

AIMR established joint laboratories called **Joint Research Centers (JRCs)** at three overseas satellites in the U.K., the U.S., and China. To employ a new postdoctoral researcher at JRC of the University of Cambridge, we did a recruitment, and we could find a young researcher appropriate to the planned collaboration theme in 2018. A new international collaboration to use first principles calculations together with persistent homology has been started. Although this is one of the activities of Core Research Cluster for Materials Science (as the project of Designated National University), also at the JRC in Tsinghua University, new postdoctoral researcher has been employed in 2018 and a new joint research on topological materials which is one of the strong points of both Tsinghua University and Tohoku University has been started. Although these postdoc researchers ordinary stay at JRCs (at the University of Cambridge or Tsinghua University), the come and stay in Sendai once or twice a year to discuss the future research plan in details and promote joint research. The postdoc at JRC in the University of Chicago has also be changed in 2019, and we are planning to restart the exchange. Although the number of the researchers related to the international collaboration through JRCs are not so many, but such collaboration is very useful in realizing firm global brain circulation.

(2) Enhancement of global brain circulation utilizing programs such as GI^3 Laboratory

AIMR is promoting researcher exchange between AIMR and overseas institutions by operating original programs, such as **GI^3 (Global Intellectual Incubation and Integration) Laboratory** Program and AIMR Overseas Dispatch Program for Young Researchers. GI^3 Lab Program and Overseas Dispatch Program are long-sustained programs which were established in FY2010 and FY2013, respectively, and have practically maintained AIMR's large-scale global brain circulation.

(3) Support by IAC encouraging global brain circulation

The team which supports all the activities for global brain circulation at AIMR is **International Affairs Center (IAC)**. The international services at AIMR were provided by "International Unit" till FY2013. In FY2014, when Organization for Advanced Studies (OAS) was established, the functions of International Unit were transferred to Research Reception Center (RRC) which was placed under the umbrella of OAS. In FY2016, RRC was reorganized into IAC and IAC started to provide even better services. IAC prepares for partnership agreement with overseas institutions form the first stage of negotiation in advance, operates GI^3 Laboratory Program and AIMR Overseas Dispatch Program for Young Researchers (procedures for invitation and dispatch of researchers), and plans international symposia including the invitation of speakers, and so on. There is no effective development in international relationship without the effort made by IAC.

(4) Cooperation with European researchers' community through academic meetings (Joint activities with other WPI Centers)

As it was before FY2016, together with members from other WPI Centers related to materials science (MANA, iCeMS, and I^{2}CNER), AIMR opened a booth and organized WPI workshops at European Materials Research Society (**E-MRS**) meetings, and also jointly participated in **NanoMat**, the Japan-France workshop on Nanomaterials and (concurrently) the WPI workshop on Materials science (held in Fukuoka in 2017 and Paris in 2019). Although this is one of the outreach activities aiming to improve the presence and visibility of WPI Program and each WPI Center, it also provides us with good opportunities to find excellent European young researchers and find collaborators, and we can say that it is the activity which contributes to the development of global brain circulation.

(5) g-RIPS and Open Innovation Center for Mathematical Science

Based on the partnership agreement with IPAM (Institute for Pure & Applied Mathematics), University of California at Los Angeles (UCLA), in FY2018, AIMR started **g-RIPS-Sendai**, a Japan's version of RIPS (Research in Industrial Projects for Students) which IPAM has organized for more than ten years. To encourage this activity further, in FY2019, AIMR established **Open Innovation Center for Mathematical Science** (Head of the center is Prof. Hiroshi Suito, Deputy Director of AIMR) as the office to operate such programs. Although the participants in g-RIPS are students, it can be said that g-RIPS is a program to contribute to the global brain circulation of future scientists, and we hope for their future activities.

Appendix 1 List of Center's Major Research Achievements

1. List of Major Refereed Papers

*List **up to 20 papers** representative of the Center's research activities during the period between FY 2017 and FY 2019, and give brief descriptions (within 5 to 10 lines) of them.
*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. If a paper has many authors, underline those affiliated with the Center.
*If a paper has many authors (say, more than 10), all of their names do not need to be listed.

AIMR's research starts from fundamental understanding of atoms and molecules which are the smallest elements of materials by direct observation of atoms and molecules, controlling atoms and molecules based on the understanding, creating new materials, and finally developing new devices and systems using the new materials. This series of the processes corresponds to the size scale from micro to macro, and from basic research to applications. The following 20 papers are arranged according to the order of size, from micro to macro.

1. Yasuhiro Takabayashi, Melita Menelaou, Hiroyuki Tamura, Aleš Štefančič, Ryotaro Arita, Matthew J. Rosseinsky, Kosmas Prassides et al., π-electron $S = ½$ quantum spin-liquid state in an ionic polyaromatic hydrocarbon. ***Nature Chemistry*** **9**, 635-643 (2017). DOI: 10.1038/nchem.2764

   [Discovery of quantum spin-liquid state] Many researchers have tried to insert alkali metals into hydrocarbons containing multiple aromatic rings to obtain new materials generating novel electronic properties such as superconductivity. However, it has been difficult to isolate a single phase by using the conventional high temperature synthesis techniques because such hydrocarbons are easily decomposed by heat and complex mixtures including broken fragments are produced. AIMR researchers developed a new route to insert alkali metals at low temperatures in solution and succeeded in synthesizing some ionic polyaromatic hydrocarbons. Through crystal structure analysis and physical property evaluation, they found that $Cs(C_{14}H_{10})$ showed behavior as a quantum spin-liquid for the first time in carbon π-electron systems. This is an epoch-making discovery which makes us expect the application to quantum computing.

2. Daichi Takane, Seigo Souma, Kosuke Nakayama, Hiroshi Kumigashira, Takashi Takahashi, Takafumi Sato et al., Observation of chiral fermions with a large topological charge and associated Fermi-arc surface states in CoSi. ***Physical Review Letters*** **122**, 076402 (2019).
   DOI: 10.1103/PhysRevLett.122.076402

   [Discovery of new fermions] According to quantum field theory, fermions in a vacuum can be classified into three types: Dirac, Weyl or Majorana fermions. Of these, only Dirac fermions have been observed as particles in high-energy physics experiments. However, Dirac and Weyl fermions also been found as quasiparticles in topological materials whose surface properties differ from their bulk properties. In this study, AIMR researchers obtained an angle-resolved photoemission spectrum by using synchrotron radiation and have found two new fermion quasiparticles that do not fit into any of the three categories. These two kinds of particles exist as quasiparticles resulting from the interaction between electrons and a crystalline lattice and cannot exist in a vacuum. This is an important result which suggests that topological materials will give us further opportunities to discover novel electronic properties.

3. Mohammad Saadatfar, Hiroshi Takeuchi, Vanessa Robins, Nicolas Francois, and Yasuaki Hiraoka, Pore configuration landscape of granular crystallization. ***Nature Communications*** **8**, 15082 (2017)
   DOI: 10.1038/NCOMMS15082

   [Crystallization process uncovered by mathematics] Persistent homology is a new mathematical tool developed in the 21st century based on homology. In this study, a mathematician of AIMR, in collaboration with some researchers from other institutions, obtained internal 3D structural data of aggregate of granular particles packed in containers by X-ray computed tomography and applied persistent homology to the obtained 3D data. The researchers succeeded in extracting the information about the change of topology during the crystallization (increase in order of the grain

arrangement with increasing packing density) and also characterizing the distorted tetrahedrons and octahedrons quantitatively by analyzing persistent diagrams. This technique can be applied to the study of other granular systems such as vibration-induced compaction or fluidity of sediments (mechanism of landslides) and is promising.

4. Deqiang Yin, Chunlin Chen, Mitsuhiro Saito, Kazutoshi Inoue, and Yuichi Ikuhara, Ceramic phases with one-dimensional long-range order. ***Nature Materials*** **18**, 19-23 (2019).
DOI: 10.1038/s41563-018-0240-0

[Discovery of the fourth solid phase] Solids were classified into two phases till the 1970's, either crystalline, with well-ordered, periodic structures, or amorphous, which lack any order. This classification scheme was disrupted by Dan Shechtman's discovery of quasicrystals, the third solid phase, in 1984, for which he was awarded the Nobel Prize in Chemistry in 2011. Quasicrystals possess long-range order but are not periodic. This time, AIMR researchers discovered the fourth solid phase and it may require revision of the classification of solid again. They observed the atomic arrangement in thin films of two metal oxides, magnesium oxide (MgO) and neodymium oxide (Nd_2O_3), by using atomic-resolution scanning transmission electron microscopy and found that the atoms had a random arrangement in two dimensions but possessed translational symmetry in the third dimension (they call "1D-ordered crystals") with the help of first principles calculations.

5. Xiaodong Hao, Akira Yoko, Chunlin Chen, Kazutoshi Inoue, Mitsuhiro Saito, Gimyeong Seong, Seiichi Takami, Tadafumi Adschiri, and Yuichi Ikuhara, Atomic-scale valence state distribution inside ultrafine CeO_2 nanocubes and its size dependence. ***Small*** **14**, 1802915 (2018).
DOI: 10.1002/smll.201802915

[Elucidating reaction mechanism by atomic resolution images] Cerium oxide (CeO_2) is a versatile ceramic, being used in a wide range of applications such as a catalyst and also known as a material having high capacity to store oxygen. To elucidate the mechanism behind the high oxygen storage capacity of this material, AIMR's researchers analyzed the distribution of the two valence states within nanocubes of cerium oxide by using scanning transmission electron microscopy (STEM) and electron energy loss spectroscopy (EELS). They obtained clear atomic scale image with high resolution which nobody had ever achieved and discovered the distribution of Ce^{3+} and Ce^{4+} ions, leading to the conclusion that smaller nanocubes are more favorable for disorption and absorption of oxygen. In this study, they also succeeded in imaging single surfactant molecules adsorbed on the surfaces of the oxide nanoparticles and solving many problems which had been unclear.

6. Gary Wolfowicz, Christopher P. Anderson, Andrew L. Yeats, Samuel J. Whiteley, Jens Niklas, Oleg G. Poluektov, F. Joseph Heremans, and David D. Awschalom, Optical charge state control of spin defects in 4H-SiC. ***Nature Communications*** **8**, 1876 (2017).
DOI: 10.1038/s41467-017-01993-4

[Control of spin defects] Defects in silicon carbide (SiC) are attracting attention as a favorable platform for optically active spin-based quantum technologies. Spin qubits exist in specific charge states of these defects, where the ability to control these states can provide enhanced spin-dependent readout and long-term charge stability. In this study, the researcher of AIMR Joint Research Center at the University of Chicago investigated this charge state control for two major spin qubits, namely, the divacancy and silicon vacancy in 4H-SiC (a hexagonal polymorph whose single period along c-axis comprises 4 SiC unit cells) and obtained bidirectional optical charge conversion between the bright and dark states of these defects. Enhancement of photoluminescence from divacancy ensembles reached up to three orders of magnitude and the conversion remained stable for hours, offering a strong basis to the future development.

7. Daniel M. Packwood, Patrick Han, and Taro Hitosugi, Chemical and entropic control on the molecular self-assembly process. ***Nature Communications*** **8**, 14463 (2017).
DOI: 10.1038/ncomms14463

[Entropic control of self-assembly] In these days, manufacturing electronic components is facing a

limitation of top-down approaches as electronic components become ever smaller, and there is an increasing push to use bottom-up processes to fabricate the components. In particular, molecular self-assembly is attracting attention as one of the most promising bottom-up methods. To understand the factors controlling the self-assembled structures, AIMR's researchers, using anthracene-based organic molecules, examined the conditions under which wire-like assembled structures formed on a copper surface during thermal annealing by focusing on the effect of enthalpy and entropy. Based on the newly developed mathematical model, surprisingly, they found that the formation of the wire-like structure was induced by the effect of entropy which normally breaks the ordered structure into disordered one. This is an important finding for structure control.

8. Kenichi Kaminaga, Daichi Oka, Tetsuya Hasegawa, and Tomoteru Fukumura, Superconductivity of rock-salt structure LaO epitaxial thin film. ***Journal of the American Chemical Society*** **140**, 6754-6757 (2018).
DOI: 10.1021/jacs.8b03009

[Superconductivity of a binary monoxide] AIMR researchers are interested in electronic properties of binary monoxides composed of rare-earth elements and oxygen, and recently found that thin films of the compound lanthanum oxide (LaO) superconduct at temperatures below about 5 kelvin. It is one kind of mystery because only two other binary monoxides have been found to be superconductors so far. And there is another mystery that only thin films with a single-crystalline structure show superconductivity. Although the critical temperature (T_c) for superconductors of LaO, 5 kelvin, seems not so high, it can be said that the T_c is very high if we compare it to those of Lanthanum monochalcogenides (LaX, where X is sulfur, selenium or tellurium) which all superconduct below 1.5 kelvin. There is a possibility that unknown principles are hidden in this mysterious material and the future development of this research is expected.

9. R. Ramos, T. Hioki, Y. Hashimoto, T. Kikkawa, P. Frey, A. J. E. Kreil, V. I. Vasyuchka, A. A. Serga, B. Hillebrands, and E. Saitoh, Room temperature and low-field resonant enhancement of spin Seebeck effect in partially compensated magnets. ***Nature Communications*** **10**, 5162 (2019).
DOI: 10.1038/s41467-019-13121-5

[Resonance between spin and sound wave] Spin Seebeck effect (SSE) is expected to be a principle which can be applied to development of low-cost and generic thermoelectric devices and improvement of the conversion efficiency of SSE is important. Resonant enhancement of spin Seebeck effect (SSE) due to sound wave in materials (phonons) was recently discovered. However, this resonant enhancement effect has been observed only at low temperatures and it has been difficult to apply this resonance to thermoelectric devices. In this study, AIMR researchers prepared a thin film of $Lu_2BiFe_4GaO_{12}$ and observed of phonon-resonant enhancement of SSE at room temperature and low magnetic field. This material showed an enhancement 700% greater than that in a film of $Y_3Fe_5O_{12}$ (YIG), the conventionally known material, and at very low magnetic fields almost one order of magnitude lower than that of YIG. This is a great progress toward applications.

10. Sergey V. Ketov, Artem S. Trifonov, Yurii P. Ivanov, Alexander Yu. Churyumov, Alexander V. Lubenchenko, Alexander A. Batrakov, Jing Jiang, Dmitri V. Louzguine-Luzgin, Jurgen Eckert, Jiri Orava, and Alan Lindsay Greer, On cryothermal cycling as a method for inducing structural changes in metallic glasses. ***NPG Asia Materials*** **10**, 137-145 (2018).
DOI: 10.1038/s41427-018-0019-4

[Reforming metallic glasses by cryothermal treatment] Although bulk metallic glasses are among the promising materials for structural applications, the lack of macroscopic ductility limits their application fields. AIMR researchers, in collaboration with researchers at AIMR Joint Research Center in the University of Cambridge, discovered that cryothermal cycling is effective in rejuvenating metallic glasses some years ago. Since it is known that thermal cycling can induce superplasticity in some polycrystalline materials, there is a possibility that cryothermal cycling is also applicable to the improvement of plasticity of metallic glasses. In this study, they applied the cryothermal cycling method to metallic glasses of three different compositions and their experiments revealed that the cryothermal cycling treatment can improve or degrade the plasticity

of a metallic glass and the atomic bond structure is important for the outcome.

11. Ryo Nakanishi, Jyunya Satoh, Keiichi Katoh, Haitao Zhang, Brian K. Breedlove, Masahiko Nishijima, Yusuke Nakanishi, Haruka Omachi, Hisanori Shinohara, and Masahiro Yamashita, $DySc_2N@C_{80}$ Single-Molecule Magnetic Metallofullerene Encapsulated in a Single-Walled Carbon Nanotube. ***Journal of the American Chemical Society*** **140**, 10955-10959 (2018).
DOI: 10.1021/jacs.8b06983

[SMMs encapsulated in CNTs] Single-molecule magnets (SMMs) are considered as next-generation quantum magnets because of their functional properties such as magnetic bistability and quantum coherence which can be applied to memory storage and quantum information processing. To use SMMs as such devices, an information pathway is needed, and single-walled carbon nanotubes (SWCNTs) are good candidates because of their excellent structural, mechanical and electronic characteristics. AIMR researchers and their collaborators tried to encapsulated $DySc_2N@C_{80}$-SMMs into the internal one-dimensional nanospace of SWCNTs. Using transmission electron microscopy, “peapod” structures were clearly observed, and the metallofullerene showed stepwise magnetic hysteresis even inside the SWCNTs. This system is the first example where SMMs have been encapsulated in SWCNTs, and the system could be used in future molecular-spintronics devices.

12. Hamzeh Kashani, Yoshikazu Ito, Jiuhui Han, Pan Liu, and Mingwei Chen, Extraordinary tensile strength and ductility of scalable nanoporous graphene. ***Science Advances*** **5**, eaat6951 (2019).
DOI: 10.1126/sciadv.aat6951

[Overcoming weaknesses of graphene] Graphene is one of the strongest materials discovered to date, hundreds of times stronger than steel. However, it is difficult to obtain strong three-dimensional structures by utilizing graphene’s two-dimensional strength because graphene’s strength is reduced if it contains any defects. Furthermore, it has been difficult to realize lightweight, carbon-based materials that are both strong and ductile. In this study, AIMR's researchers, inspired by metamaterials, made an ultralight graphene structure containing nanoscale pores that has an excellent tensile strength and ductility. More specifically, they obtained three-dimensional seamless tubular network of graphene by using nanoporous nickel as a template for the growth of graphene. This result has broader implications for two-dimensional materials besides graphene, giving an idea to design materials which will overcome their weak points.

13. Hiroya Abe, Yutaro Hirai, Susumu Ikeda, Yasutaka Matsuo, Haruyuki Matsuyama, Jun Nakamura, Tomokazu Matsue, and Hiroshi Yabu, Fe azaphthalocyanine unimolecular layers (Fe AzULs) on carbon nanotubes for realizing highly active oxygen reduction reaction (ORR) catalytic electrodes. ***NPG Asia Materials*** **11**, 57 (2019).
DOI: 10.1038/s41427-019-0154-6

[Realization of catalytic activity surpassing platinum] In development of hydrogen fuel cells, one obstacle for their commercialization has been the fact that the most effective catalysts for the oxygen-splitting reaction that occurs on their cathodes are expensive because they contain platinum. The same problem arises in metal-air batteries. Therefore, researchers have been searching for platinum-free catalysts with high catalytic activities. AIMR researchers focused on iron azaphthalocyanines (FeAzPc) and tried to attach this molecule on the surface of multiwalled carbon nanotubes, and found the condition to make nanotubes with a single layer of molecules of FeAzPc. This material shows a catalytic activity superior to that of platinum-based catalysts, and it was found that this high activity is due to the favorable positioning of nitrogen atoms in the FeAzPc rings. A new company "AZUL Energy" has been established to supply the catalysts worldwide.

14. Deepak Kumar, Joseph D. Paulsen, Thomas P. Russell, and Narayanan Menon, Wrapping with a splash: High-speed encapsulation with ultrathin sheets. ***Science*** **359**, 775-778 (2018).
DOI: 10.1126/science.aao1290

[An amazing film wraps up in a hurry] A principal investigator of AIMR working in the United States,

along with some collaborators, devised a simple and elegant method that can encase liquid droplets in polymer films in a few tens of milliseconds. Their technique involves simply releasing a drop of liquid from a specific height onto a small, thin polymer sheet floating on the surface of another liquid. As the drop sinks into the liquid, the polymer sheet wraps around it, encasing it completely. Surface tension ensures the seams that form in the polymer are nearly perfect with no gaps or overlaps. Unlike conventional encapsulation techniques that generally produce only spherical droplets, the technique can produce capsules of different shapes by varying the shape of the polymer film. The researchers plan to expand this research oriented toward materials science, for example, combination with carbon nanotubes.

15. Thangavel Kanagasekaran, Hidekazu Shimotani, Ryota Shimizu, Taro Hitosugi, and Katsumi Tanigaki, A new electrode design for ambipolar injection in organic semiconductors. ***Nature Communications*** **8**, 999 (2017).
DOI: 10.1038/s41467-017-01047-9

[An epochal electrode for carrier injection] One of the problems in organic semiconductor devices is a carrier injection barrier at the interface between electrodes and a semiconductor. Generally, as the electrodes, gold is used for hole injection and a metal having a low work function such as calcium is used for electron injection. However, metals such as calcium are unstable in air, and solving this electrode problem has been a matter requiring immediate attention. AIMR researchers have overcome this problem by fabricating a unique electrode structure: a disordered organic semiconductor layer sandwiched between a metal thin film and a single-crystal organic semiconductor layer. The structure has a novel carrier injection mechanism that results in a very low barrier, and the electrode is effective for the injection of both electrons and holes. They also demonstrated bright light emission from the organic semiconductor with a very high current density.

16. Kazuya Z. Suzuki, Shojiro Kimura, Hitoshi Kubota, Shigemi Mizukami, Magnetic Tunnel Junctions with a Nearly Zero Moment Manganese Nanolayer with Perpendicular Magnetic Anisotropy. ***ACS Applied Materials & Interfaces*** **10**, 43305-43310 (2018).
DOI: 10.1021/acsami.8b15606

[Magnetic tunnel junctions using ferrimagnet] A magnetic tunnel junction consists of two magnetic layers separated by an insulating layer, and usually information is stored and erased by switching the relative magnetization of the two layers using an electric current. Ideally, it is better to use magnetic anisotropy for the switch and control it by an electric voltage, but it has been difficult to find materials that exhibit voltage-controlled magnetic anisotropy. In particular, the large stray magnetic field was a bottleneck in conventional materials. AIMR researchers have used a new ferrimagnet, which generates negligible stray fields, to realize a magnetic tunnel junction that exhibits voltage-controlled magnetic anisotropy. More specifically, they achieved this by including a very thin layer of manganese grown on cobalt gallium (CoGa) in the junction, and the manganese nanolayer behaved as a ferrimagnetic and possessed perpendicular magnetic anisotropy.

17. Sangryun Kim, Hiroyuki Oguchi, Naoki Toyama, Toyoto Sato, Shigeyuki Takagi, Toshiya Otomo, Dorai Arunkumar, Naoaki Kuwata, Junichi Kawamura, and Shin-ichi Orimo, A complex hydride lithium superionic conductor for high-energy-density all-solid-state lithium metal batteries. ***Nature Communications*** **10**, 1081 (2019).
DOI: 10.1038/s41467-019-09061-9

[Complex hydride promising as solid electrolyte for lithium batteries] Lithium-ion batteries are used all around the world, but they can suffer from several drawbacks, including low energy densities, leakage of the liquid electrolyte, and the potential to burst into flames. These problems could be overcome by replacing the liquid electrolyte with a solid one. A research team led by an AIMR's principal investigator has developed a complex hydride that combines both a high lithium conductivity and a good stability with lithium metal anodes. This material consisted of a mixture of two types of anions: 70% of anions contain one carbon atom and nine boron atoms (as in $(CB_9H_{10})^-$), while 30% contain one carbon atom and eleven boron atoms (as in $(CB_{11}H_{12})^-$). They found that the resistance between their complex hydride and a lithium metal anode was almost negligible,

meaning that lithium ions can freely move between the anode and electrolyte.

18. Akio Higo, Seiji Samukawa et al., Photoluminescence of InGaAs/GaAs Quantum Nanodisk in Pillar Fabricated by Biotemplate, Dry Etching, and MOVPE Regrowth. ***ACS Applied Electronic Materials*** **1**, 1945-1951 (2019).
DOI: 10.1021/acsaelm.9b00432

[Realization of 3D quantum dots structure] The III−V compound semiconductors such as GaAs show high efficiencies of absorption and emission of light compared to silicon and their quantum dots (QDs) are expected to show fascinating characteristics and performance as photonic devices thanks to quantum effect. Although it is necessary to create defect-free QDs in order to maximize their device performance, it has been difficult to obtain such defect-free QDs because compound semiconductors are fragile for dry-etching used in top-down device processing. AIMR researchers, in collaboration with some researchers from other institutions, combined bottom-up process utilizing bio-templates and top-down process using neutral beam etching, which is very mild etching compared to the conventional dry-etching, and succeeded in fabricating a photonic device with high emission efficiency in which disk-shaped InGaAs QDs are floating in massive GaAs body.

19. Hideaki Yamamoto, Satoshi Moriya, Katsuya Ide, Takeshi Hayakawa, Hisanao Akima, Shigeo Sato, Shigeru Kubota, Takashi Tanii, Michio Niwano, Sara Teller, Jordi Soriano, and Ayumi Hirano-Iwata, Impact of modular organization on dynamical richness in cortical networks. ***Science Advances*** **4**, eaau4914 (2018).
DOI: 10.1126/sciadv.aau4914

[Neuronal networks in dishes] The human brain is made up of specialized regions that process signals from different sources. However, in addition to this segregation of activities, processed signals from the different brain regions need to be integrated. Generally speaking, integration is when different neuronal groups activate coherently, whereas segregation is a state where the neuronal groups activate independently. But it has not been clear how the brain coordinates these two mutually exclusive activities, synchronization and asynchronization. AIMR researchers, together with some collaborators at home and abroad, created a very simple model of a brain by linking four modules made up of circuits of rat neurons and investigated how they integrate when they varied the degree of physical coupling between them. They discovered that segregation and integration coexist only when there is almost no coupling between the four modules.

20. William A. Borders, Ahmed Z. Pervaiz, Shunsuke Fukami, Kerem Y. Camsari, Hideo Ohno, and Supriyo Datta, Integer factorization using stochastic magnetic tunnel junctions. ***Nature*** **573**, 390–393 (2019).
DOI: 10.1038/s41586-019-1557-9

[A spintronics device which behaves like a quantum annealing machine] Quantum computing uses qubits to represent a superposition of 0 and 1 while conventional computers operate using strings of 0 and 1 called bits to represent information. In this study, AIMR researchers, in collaboration with some researchers from Purdue University, developed a spintronics device which was based on a brand-new concept and constructed system which behaved a quantum annealing machine. In the new spintronic device, probabilistic bit (called a p-bit) which fluctuates in time between 0 and 1, and interacts with other p-bits in the same system using principles inspired by neural networks. Specifically, they developed nanoscale magnetic tunnel junctions showing stochastic behavior as p-bit at room temperature. The researchers demonstrated factorization of integers up to 945 using eight correlated p-bits, and the results show good agreement with theoretical predictions.

2. Major Invited Lectures, Plenary Addresses (etc.)

*List up to 10 main presentations made between FY 2017 and FY 2019 in order from most recent.
*For each, write the date(s), lecturer/presenter's name, presentation title and conference name.

Date(s)	Lecturer/Presenter's name	Presentation title	Conference name
2019.12.4-7	Takafumi Sato PI	Electronic states of exotic topological semimetals studied by ARPES (Plenary talk)	TopoMat2019 (Kyoto, Japan)
2019.9.27-29	Tadafumi Adschiri PI	Supercritical Route for Nano Catalyst (Plenary talk)	The 11th International Conference on Supercritical Fluids-Supergreen 2019 (Xi'an, China)
2019.9.4	Yuichi Ikuhara PI	Atomic-scale Dynamic Observations of Grain Boundary and Surface Phenomena (Plenary talk, Distinguished lecture)	17th Frontiers of Electron Microscopy in Materials Science (FEMMS 2019) (Asheville, USA)
2019.7.15-19	Hiroshi Suito PI	Geometrical characteristics of human anatomical structure in thoracic diseases (Plenary talk)	The 9th international congress on industrial and applied mathematics (ICIAM 2019) (Valencia, Spain)
2019.7.9-11	Tomoteru Fukumura PI	Rich electric and magnetic functionalities in rare earth binary oxides (Invited talk)	The 11th International Conference on the Science and Technology for Advanced Ceramics (STAC-11) (Tsukuba, Japan)
2019.2.27	Seiji Samukawa PI	Atomic layer defect-free etching and deposition processes for future sub-10-nm devices (Plenary talk)	7th International Conference on Advanced Plasma Technologies (ICAPT-7) (Hue, Vietnam)
2019.1.20	Shin-ichi Orimo PI	Materials Science of High-Density Hydrides - Toward the HYDROGENOMICS - (Invited talk)	The 13th international hydrogen & Energy symposium (Incheon, Korea)
2018.12.13-14	Ayumi Hirano PI	Stable Lipid Bilayers in Microfabricated Silicon Chips as a Platform for Ion Channel Proteins (Invited talk)	Taiwan-Japan-Korea Trilateral Conference on Nanomedicine (Tainan, Taiwan)
2018.4.29-5.4	Masahiro Yamashita PI	New Quantum Molecular Spintronics Based on Single-Molecule Magnets: Single-Molecule Memory, Spin Qubits, and Rabi Nutation at RT (Plenary talk)	6th International Conference on Superconductivity and Magnetism (Antalya, Turkey)
2017.9.4	Shigemi Mizukami PI	Manganese-based Spintronics (Plenary talk)	International Conference of Frontiers in Materials Science (FMS2017) (Greifsward, Germany)

3. Major Awards

*List main awards received between FY 2017 and FY 2019 in order from the most recent.
*For each, write the date issued, recipient's name and the name of award. In case of multiple recipients, underline those affiliated with the Center.

Date	Recipient's name	Name of award
March 26, 2020	Masahiro Yamashita PI	The 72nd Chemical Society of Japan (CSJ) Award
November 19, 2019	Eiji Saitoh, Mingwei Chen, Thomas P. Russell and Qikun Xue (PIs)	Selected as Clarivate Analytics Highly Cited Researchers 2019
May 30, 2018	Tadafumi Adschiri PI	Medal with Purple Ribbon
April 17, 2019	Hiroshi Suito PI	FY 2019 Prizes for Science and Technology (Research Category) from MEXT
September 9, 2018	Yuichi Ikuhara PI	"The Hatsujiro Hashimoto Medal" (Applications in Physical Sciences) from the International Federation of Societies for Microscopy（IFSM)
October 15, 2018	Terunobu Miyazaki, Professor Emeritus (former PI)	NIMS Award 2018
April 17, 2018	Kosmas Prassides PI	FY 2018 Prizes for Science and Technology (Research Category) from MEXT He is the second foreign researcher of AIMR who won this MEXT's prize.
February 2, 2018	Eiji Saitoh PI	The 34th Inoue Prize for Science from the Inoue Foundation for Science
January 5, 2018	Hideo Ohno PI and Seiji Samukawa PI	Selected as the IEEE (The Institute of Electrical and Electronics Engineers) Fellows
December 22, 2017	Yasumasa Nishiura, Specially Appointed Professor (former PI)	FY2017 MIMS Mimura Award (as commendation to persons who have achieved exceptional accomplishment in mathematical sciences)

Appendix 2 FY 2019 List of Principal Investigators

NOTE:

*Underline names of principal investigators who belong to an overseas research institution.

*Indicate newly added researchers in FY 2019 (2019.4.1-2020.3.31) in the “Notes” column.

	<Principal Investigators at the end of FY 2019>					Principal Investigators Total: 24
Name	Age	Affiliation (Position title, department, organization)	Academic degree, Specialty	Effort (%)*	Starting date of participation	Status of participation (Describe in concrete terms)	Note
Center Director Shin-ichi Orimo	54	Professor, AIMR, Tohoku University	Ph.D. / Materials Engineering and Chemistry	80%	From Jan. 2013	Usually stays at the center	Appointed to Center Director on October 1st, 2019
Deputy Center Director Hiroshi Suito	58	Professor, AIMR, Tohoku University	Dr. of Engineering / Mathematical Modeling and Numerical Simulation	80%	From Apr. 2017	Usually stays at the center	Appointed to Deputy Center Director on October 1st, 2019
Tadafumi Adschiri	62	Professor, AIMR, Tohoku University	Dr. of Engineering / Hybrid Materials, Supercritical Fluid Technology	80%	From start	Usually stays at the center	
Hayato Chiba	38	Professor, AIMR, Tohoku University	Ph. D. / Informatics	100%	From Apr. 2019	Usually stays at the center	Appinted to PI on April 1st, 2019
Shunsuke Fukami	39	Professor, Research Institute of Electrical Communication (RIEC), Tohoku University	Dr. of Engineering / Spintronics	40%	Junior PI: From Apr. 2018 PI: From Jan. 2020	Usually stays at RIEC, close to the center, and participate in the center's activities	Promoted to PI from Junior PI on Jan. 1st, 2020
Tomoteru Fukumura	50	Professor, AIMR, Tohoku University	Dr. of Engineering / Solid State Chemistry	80%	From Dec. 2016	Usually stays at the center	
Ayumi Hirano	50	Professor, AIMR, Tohoku University	Dr. of Science / Bio-devices	80%	From Oct. 2016	Usually stays at the center	

*Percentage of time that the principal investigator devotes to his/her work for the Academy center vis-à-vis his/her total working hours.

Motoko Kotani	60	Professor, AIMR, Tohoku University (Advisor to the Center Director)	Dr. of Science / Mathematics (Geometry)	20%	From March 2011	Cross-appointment with RIKEN	
Dmitri Valentinovich Louzguine	52	Professor, AIMR, Tohoku University cross-appointment: AIST-TohokuU Mathematics for Advanced Materials Open Innovation Laboratory (MathAM-OIL)	Dr. of Engineering / Materials Science	30%	Professor: From Dec. 2007 PI: From 2009	Cross-appointment (MathAM-OIL, AIST 70% and AIMR, Tohoku University 30%). Usually stays at the center	
Shigemi Mizukami	47	Professor, AIMR, Tohoku University	Dr. of Engineering / Applied Physics, Spintronics	80%	Assist. (Assoc.) Prof.: From Apr. 2008 Professor and PI: From Nov. 2014	Usually stays at the center	
Seiji Samukawa	60	Professor, Institute of Fluid Science (IFS), Tohoku University	Dr. of Engineering / Nano-Process Engineering	40%	From Apr. 2012	Usually stays at IFS, close to the center, and participate in the center's activities	
Takafumi Sato	45	Professor, AIMR, Tohoku University	Ph.D. / Physics	80%	From Apr. 2019	Usually stays at the center	Appointed to PI on April 1st, 2019
Katsumi Tanigaki	65	Professor, AIMR, Tohoku University	Dr. of Engineering / Nano Materials Science	80%	From start	Usually stays at the center	
Masahiro Yamashita	65	Professor, AIMR, Tohoku University	Dr. of Science / Coordination Chemistry	80%	From Dec. 2016	Usually stays at the center	
Yuichi Ikuhara	61	Professor, School of Engineering, Institute of Engineering Innovation, The University of Tokyo	Dr. of Engineering / Ceramics, Electron microscopy	30%	From start	Stays at the center once a month	
Eiji Saitoh	48	Professor, Department of Applied Physics, School of Engineering. The University of Tokyo	Dr. of Engineering / Quantum Nano Science	30%	From Apr. 2012	Stays at the center once a month	Moved to the University of Tokyo (cross-appointment)
Mingwei Chen	54	Professor, Johns Hopkins University, Whiting School of Engineering	Dr. of Engineering / Materials Science	20%	From start	・Stays at center four times (about two months in total) a year. ・Attends the AIMR conference	

Yong P. Chen	40	Professor, Department of Physics and School of Electrical and Computer Engineering, Purdue University	Ph.D. / Condensed Matter Physics, Nanotechnology	20%	From Apr. 2017	・Stays at center three times (more than two months in total) a year. ・Attends the AIMR conference	
Tomasz Dietl	69	Professor, Head of Laboratory of Cryogenic and Spintronic Research,Institute of Physics, Polish Academy of Sciences	Ph.D./ Condensed Matter Physics (Theory)	20%	From Apr. 2012	・Styas at the center once a year ・Attends the AIMR conference	
Alan Lindsay Greer	64	Professor, Department of Materials Science & Metallurgy, University of Cambridge	Ph.D. / Metallurgy & Materials Science	20%	From start	・Styas at the center once a year ・Attends the AIMR conference	
Chris Pickard	45	Professor, Department of Materials Science & Metallurgy, University of Cambridge	Ph.D. / Materials Theory	20%	From Apr. 2016	・Stays at the center once a year ・Attends the AIMR conference ・Conducts PD at AIMR Joint Research Center.	
Thomas P. Russell	67	Professor, Department of Polymer Science and Technology, University of Massachusetts Amherst	Ph.D. / Nano-Science Technology	20%	From start	・Stays at the center once a year ・Attends the AIMR conference	
Alexander Shluger	65	Professor, Department of Physics and Astronomy, University College London (UCL)	Ph.D. / Computational Materials Science, Condensed Matter Physics	20%	From start	・Stays at the center once a year ・Attends the AIMR conference	
Qi-kun Xue	56	Professor, Department of Physics, Tsinghua University	Ph.D. / Surface Science	20%	From start	・Dispatchs a PD Researcher ・Attends the AIMR conference	

Principal Investigators resigned since FY 2017

Name	Next Affiliation (Position title, department, organization)	Period of participation
Yasuaki Hiraoka	Professor, Institute for Advanced Study, Kyoto University / Deputy Director of WPI-ASHBi, Kyoto University	From Jul. 2016 till Mar. 2018
Hideo Ohno	President, Tohoku University	From Apr. 2012 till Mar. 2018
Kosmas Prassides	Professor, Department of Materials Science, Graduate School of Engineering, Osaka Prefecture University,	From Apr. 2013 till Sep. 2018
Takashi Takahashi	Researcher, Sato Laboratory, AIMR, Tohoku University	From start till Mar. 2019
Ali Khademhosseini	Professor, California NanoSystems Institute, University of California Los Angeles	From Nov. 2009 till Mar. 2018
Winfried Teizer	Professor, NanoLab in the Physics & Astronomy Department, Texas A&M University	From Nov. 2009 till Mar. 2019

Appendix 3-1 Record of Center Activities (FY 2017-FY 2019)

1. Researchers and Center Staffs, Satellites, Partner Institutions

1-1. Researchers and Center Staffs Participated in the Center's Activities

- Enter the number of researchers and center staffs affiliated with the Center in the table in Appendix 3-1a.

Special mention

- Describe the Center's concrete plans for the future and already-established schedules for employing researchers, particularly principal investigators.
- As background to how the Center is working on the global circulation of 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.
- In Appendix 3-1b, describe the positions that postdoctoral researchers acquire upon leaving the Center.

- Please refer to Appendix 3-1a and Appendix 3-1b with respect to the number of researchers and staffs affiliated with the Center and the positions that postdoctoral researchers have acquired after leaving the Center, respectively.
- AIMR is planning to invite Prof. Gerrit Ernst-Wilhelm Bauer who is one of the world authorities on spintronics theory and Prof. Hirotomo Nishihara who is attracting much attention by the achievements in carbon nanomaterials research as new PIs in April 2020.
- Prof. Yong P. Chen who was appointed to a PI of AIMR in April 2017 is one of the world leaders in topological materials research field. Although he is currently a full professor of Purdue University, the United States, he is concurrently holding a position as a PI of AIMR by cross-appointment and stays 2-3 month every year, working at Prof. Yong P. Chen Laboratory built in AIMR Main Building with young researchers of his group in AIMR. Prof. Chen is developing global collaboration by putting his activity bases in the U.S., Japan and China, and the researchers and students he has fostered are performing research by coming and going to these places; these activities are contributing to promoting global brain circulation.

1-2. Satellites and Partner Institutions

- List the satellite and partner institutions, both domestic and overseas, in the table below.
- Indicate newly added and deleted institutions in the "Notes" column.

<Satellite institutions>

Institution name	Principal Investigator(s), if any	Notes
University of Cambridge	Alan Lindsay Greer Chris Pickard	
The University of Chicago		
Tsinghua University	Qikun Xue	

< Partner institutions>

Institution name	Principal Investigator(s), if any	Notes
University College London	Alexander Shluger	
Polish Academy of Sciences	Tomasz Dietl	
University of Massachusetts Amherst	Thomas P. Russell	
Purdue University	Yong P. Chen	

Johns Hopkins University	Mingwei Chen	
University of California, Santa Barbara		
University of California, Los Angeles		
Texas A&M University		
University of Wisconsin		
Chemnitz University of Technology		

2. Status of Collaboration with Overseas Satellites

2-1. Coauthored Papers

- List the refereed papers published between FY 2017 and FY 2019 that were coauthored between the Center's researcher(s) in domestic institution(s) (include satellite institutions) 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.

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

1) D. V. Louzguine-Luzgin, V. Yu. Zadorozhnyy, S. V. Ketov, Z. Wang, A. A. Tsarkov, and *A. L. Greer*, On room-temperature quasi-elastic mechanical behaviour of bulk metallic glasses. ***Acta Materialia*** **129**, 343-351 (2017).
DOI: 10.1016/j.actamat.2017.02.049
2) *Jiri Orava* and *A. Lindsay Greer*, Classical-nucleation-theory analysis of priming in chalcogenide phase-change memory. ***Acta Materialia*** **139**, 226-235 (2017).
DOI: 10.1016/j.actamat.2017.08.013
3) *Jiri Orava*, Yuren Wen, Jan Prikryl, Tomas Wagner, Nadia A. Stelmashenko, Mingwei Chen, and *A. Lindsay Greer*, Preferred location for conducting filament formation in thin-film nano-ionic electrolyte: study of microstructure by atom-probe tomography. ***Journal of Materials Science: Materials in Electronics*** **28**, 6846–6851(2017)
DOI: 10.1007/s10854-017-6383-y
4) Sergey V. Ketov, Artem S. Trifonov, Yurii P. Ivanov, Alexander Yu. Churyumov, Alexander V. Lubenchenko, Alexander A. Batrakov, Jing Jiang, Dmitri V. Louzguine-Luzgin, Jurgen Eckert, *Jiri Orava*, and *Alan Lindsay Greer*, On cryothermal cycling as a method for inducing structural changes in metallic glasses. ***NPG Asia Materials*** **10**, 137-145 (2018).
DOI: 10.1038/s41427-018-0019-4
5) D. V. Louzguine-Luzgin, J. Jiang, A. I. Bazlov, V.S. Zolotorevzky, H. Mao, Yu P. Ivanov, and *A. L. Greer*, Phase separation process preventing thermal embrittlement of a Zr-Cu-Fe-Al bulk metallic glass. ***Scripta Materialia*** **167**, 31-36 (2019).
DOI: 10.1016/j.scriptamat.2019.03.030
6) D. V. Louzguine-Luzgin, M. Miyama, K. Nishio, A. A. Tsarkov, and *A. L. Greer*, Vitrification and nanocrystallization of pure liquid Ni studied using molecular-dynamics simulation. ***The Journal of Chemical Physics*** **151**, 124502 (2019).
DOI: 10.1063/1.5119307
7) Bonan Zhu, *Georg Schusteritsch*, Ping Lu, Judith L. MacManus-Driscoll, and *Chris J. Pickard*, Determining interface structures in vertically aligned nanocomposite films editors-pick. ***APL Materials*** **7**, 061105 (2019).
DOI: 10.1063/1.5099204

Overseas Satellite 2 The University of Chicago (Total: 2 papers)

1) *Gary Wolfowicz*, Christopher P. Anderson, Andrew L. Yeats, Samuel J. Whiteley, Jens Niklas, Oleg G. Poluektov, F. Joseph Heremans, and *David D. Awschalom*, Optical charge state control of spin defects in 4H-SiC. ***Nature Communications*** **8**, 1876 (2017).
DOI: 10.1038/s41467-017-01993-4

2) *Gary Wolfowicz*, Samuel J. Whiteley, and *David D. Awschalom*, Electrometry by optical charge conversion of deep defects in 4H-SiC. ***Proceedings of the National Academy of Sciences of the United States of America*** **115**, 7879-7883 (2018).
DOI: 10.1073/pnas.1806998115

Overseas Satellite 3 Tsinghua University (Total: 2 papers)
1) Yongzheng Zhang, Jing Du, Ziqian Wang, Min Luo, Yuan Tian, Takeshi Fujita, *Qikun Xue*, and Mingwei Chen, Three-Dimensional Nanoporous Heterojunction of Monolayer MoS_2@rGO for Photoenhanced Hydrogen Evolution Reaction. ***ACS Applied Energy Materials*** **1**, 2183-2191 (2018).
DOI: 10.1021/acsaem.8b00234
2) Yongzheng Zhang, JingDu, Ruichun Luo, Ziqian Wang, Zhili Wang, Jiuhui Han, Pan Liu, Takeshi Fujita, *Qikun Xue*, and Mingwei Chen, 3D bicontinuous nanoporous plasmonic heterostructure for enhanced hydrogen evolution reaction under visible light. ***Nano Energy*** **58**, 552-559 (2019).
DOI: 10.1016/j.nanoen.2019.01.073

2-2. Status of Researcher Exchanges

- Using the below tables, indicate the number of researcher exchanges between the Center (include domestic satellite institutions) and overseas satellite institutions during the period of FY 2017-FY 2019. Enter by institution and fiscal year.
- Write the number of principal investigator visits in the upper space and the number of other researcher visits in the lower space.

Overseas Satellite 1: University of Cambridge

<To overseas satellite>

	FY 2017	FY 2018	FY 2019	Total
Principal investigators	0	0	1	1
Other researchers	1	0	1	2
Total	1	0	2	3

<From overseas satellite>

	FY 2017	FY 2018	FY 2019	Total
Principal investigators	1	1	1	3
Other researchers	0	1	2	3
Total	1	2	3	6

Overseas Satellite 2: The University of Chicago

<To overseas satellite>

	FY 2017	FY 2018	FY 2019	Total
Principal investigators	0	0	0	0
Other researchers	0	0	0	0
Total	0	0	0	0

<From overseas satellite>

	FY 2017	FY 2018	FY 2019	Total
Principal investigators	0	0	0	0
Other researchers	1	0	0	1
Total	1	0	0	1

Overseas Satellite 3: Tsinghua University

<To overseas satellite>

	FY 2017	FY 2018	FY 2019	Total
Principal investigators	4	0	3	7
Other researchers	2	1	1	4
Total	6	1	4	11

<From overseas satellite>

	FY 2017	FY 2018	FY 2019	Total
Principal investigators	0	2	0	2
Other researchers	0	26	1	27
Total	0	28	1	29

3. Holding and Participating in International Research Meetings

3-1. Holding international Research Meetings

- Indicate the number of international research conferences or symposiums held between FY 2017 and FY 2019, and give up to five examples of the most representative ones using the table below.

FY 2017: 1 meeting	FY 2018: 1 meeting	FY 2019: 2 meetings
Major examples (meeting titles, places and dates held)		Number of participants
Kick-off Symposium for World Leading Research Centers for Materials Science and Spintronics (Sendai, Feb 18 to 20, 2018)		From domestic institutions: 358 From overseas institutions: 15
The 2nd Symposium for World Leading Research Centers for Materials Science and Spintronics (Sendai, Feb 15 to 18, 2019)		From domestic institutions: 234 From overseas institutions: 20
The 3rd Symposium for The Core Research Clusters for Materials Science and Spintronics (Sendai, Feb 9 to 11, 2020)		From domestic institutions: 239 From overseas institutions: 13
The Fraunhofer Symposium (Sendai, April 15th, 2019)		From domestic institutions: 52 From overseas institutions: 8

3-2. Participating in International Research Meetings

- Give up to five examples of the most representative case in which the Center, not individual researchers, participated in international research meetings to enhance the visibility and brand of the Center or of the overall WPI Program

Meeting titles, places, dates held and number of participants	Form of participation (e.g. operating a booth)	Number of participants from the Center
NanoMat2017 (The 12th Japan-France Workshop on Nanomaterials and the 3rd WPI Workshop on Materials Science), Fukuoka, Japan (held mainly at the main building of I^2CNER), May 17-19, 2017.	Introduction of WPI Program, each WPI Center (AIMR, MANA, iCeMS and I^2CNER), and organizations of French side. Oral and poster presentations given by researchers.	6

The number of participants: 35 presenters and about 20 other participants (Total about 55)		
E-MRS 2017 Spring Meeting Strasbourg, France May 22-26, 2017 The number of participants: 2,350	Dr. Susumu Ikeda, Deputy Administrative Director for research of AIMR gave a presentation introducing WPI Program and AIMR on behalf of WPI at a reception (STAM Prestige Lectures 2017) organized by Science and Technology of Advanced Materials (STAM).	1
E-MRS 2018 Spring Meeting Strasbourg, France June 18-22, 2018 The number of participants: 2,780	Operating a WPI's booth (The main coordinator was AIMR). Organizing a WPI Workshop (joint organization with STAM; The main coordinator was AIMR). Oral and poster presentations given by WPI researchers at individual scientific sessions.	7
E-MRS 2019 Spring Meeting Nice, France May 27-31, 2019 The number of participants: 2,720	Operating a WPI's booth (The main coordinator was I^2CNER). Oral and poster presentations given by WPI researchers at individual scientific sessions. Participation in a workshop jointly organized by WPI-MANA and a French institution. Prof. Akichika Kumatani from AIMR gave a talk.	7
NanoMat2019 (The 13th Japan-France Workshop on Nanomaterials and the 4th WPI Workshop on Materials Science), Paris, France, June 3-5, 2019. The number of participants: 45 presenters and about 10 other participants (Total about 55)	Introduction of each WPI Center (AIMR, MANA, iCeMS and I^2CNER) and organizations of French side. Oral and poster presentations given by researchers.	5

4. List of the Cooperative Research Agreements with Overseas Institutions

- Indicate the number of agreements concluded with overseas institutions still in effect as of the end of FY 2019 (March 31, 2020). Give five examples of the most representative agreements.

Number of effective agreements (as of March 31, 2019): 6

Five examples of the most representative agreements:

1. **Name of an Agreement:** AGREEMENT ON ACADEMIC EXCHANGE BETWEEN THE WORLD PREMIER INTERNATIONAL RESEARCH CENTER ADVANCED INSTITUTE FOR MATERIALS RESEARCH (WPI-AIMR) TOHOKU UNIVERSITY, JAPAN AND THE DEPARTMENT OF MATERIALS SCIENCE AND METALLURGY (MSM) UNIVERSITY OF CAMBRIDGE, UNITED KINGDOM
   Dates of an Agreement: January 26, 2010
   Counterpart of an Agreement: The Department of Materials Science and Metallurgy (MSM), University of Cambridge
   Summary of an Agreement:
   - Promotion of joint research and educational activities
   - Invitation to short-term visits of researchers for academic activities
   - Exchange of information and pertinent publication in fields of interest to both universities
   - Exchange of faculty members, researchers and students for study and research

2. **Name of an Agreement:** MEMORANDUM OF UNDERSTANDING REGARDING THE PROPOSED JOINT RESEARCH CENTER BETWEEN AIMR AND THE UNIVERSITY OF CHICAGO
   Dates of an Agreement: April 16, 2014
   Counterpart of an Agreement: The University of Chicago
   Summary of an Agreement:
   Operation of the U.CHICAGO/AIMR Joint Research Center at both institutes

3. **Name of an Agreement:** Collaborative Research Agreement
   Dates of an Agreement: June 15, 2018
   Counterpart of an Agreement: Tsinghua University
   Summary of an Agreement:
   Operation of the Joint Research Team at both institutes

The following descriptions regarding the two effective agreements were added on July 30, 2021.

4. **Name of an Agreement:** Amendment Agreement (#1 and #2) to Framework for a Joint Initiative Between Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. as legal entity for its Fraunhofer-Institute for Electronic Nano-Systems ENAS and Tohoku University for its Advanced Institute for Materials Research - AIMR
   Dates of an Agreement: #1 December 17, 2018 (effective as from April 1, 2017) and #2 May 7, 2020 (effective as from October 1, 2018)
   Counterpart of an Agreement: Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.
   Summary of an Agreement:
   Operation of Fraunhofer Project Center for NEMS/MEMS devices and manufacturing technologies at AIMR, Tohoku University and promotion of collaboration between AIMR and Fraunhofer-Institute for Electronic Nano-Systems (ENAS)

5. **Name of an Agreement:** MEMORANDUM OF UNDERSTANDING The Regents of The University of California, on Behalf of Its Los Angeles Campus, USA AND The Advanced Institute for Materials Research (AIMR) Tohoku University, Japan
   Dates of an Agreement: June 8, 2018
   Counterpart of an Agreement: Institute for Pure and Applied Mathematics (IPAM),

University of California, Los Angeles (UCLA)

Summary of an Agreement:

Development of collaborations and exchanges between AIMR and IPAM through mutual visitation, holding of joint symposia/meetings, and coordination of joint research programs

5. Postdoctoral Positions through Open International Solicitations

- In the columns "number of applications" and "number of selections," put the total number (upper) and the number and percentage of overseas researchers in the < > brackets (lower).
- In Appendix 3b, describe the status of employment of postdoctoral researchers.

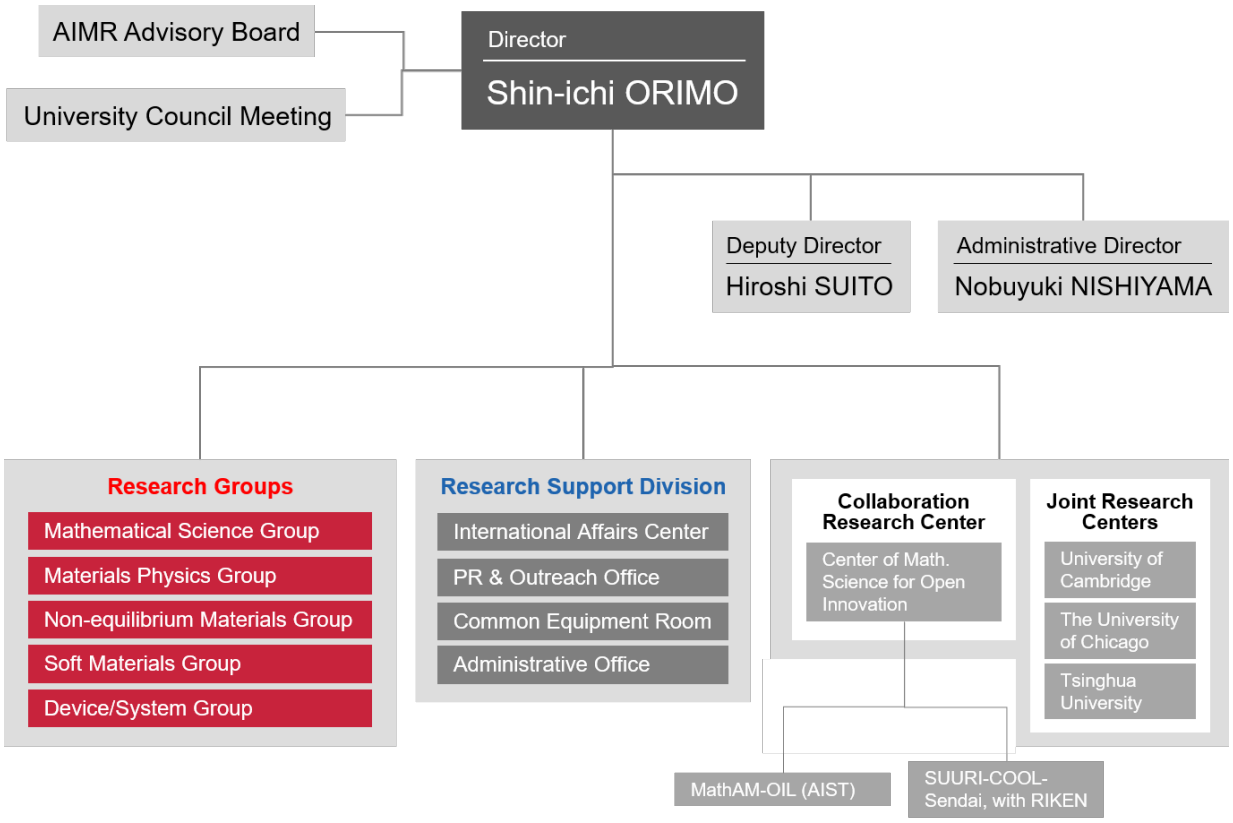
Fiscal year	Number of applications	Number of selections
FY 2016	5	2
	〈4, 80%〉	〈1, 50%〉
FY 2017	168	4
	〈159, 95%〉	〈2, 50%〉
FY 2018	25	2
	〈24, 96%〉	〈1, 50%〉
FY 2019	7	1
	〈7, 100%〉	〈1, 100%〉

6. Diagram of Management System

6-1.

- Diagram the Center's management system within the Center in an easily understood manner.
- If any changes have been made in the Center's management system vis-à-vis that stated in the application for WPI Academy center certification, describe them. Especially describe any important changes made in such as the center director, administrative director, head of host institution, and officer(s) in charge at the host institution (e.g., executive vice president for research).

Management System within AIMR

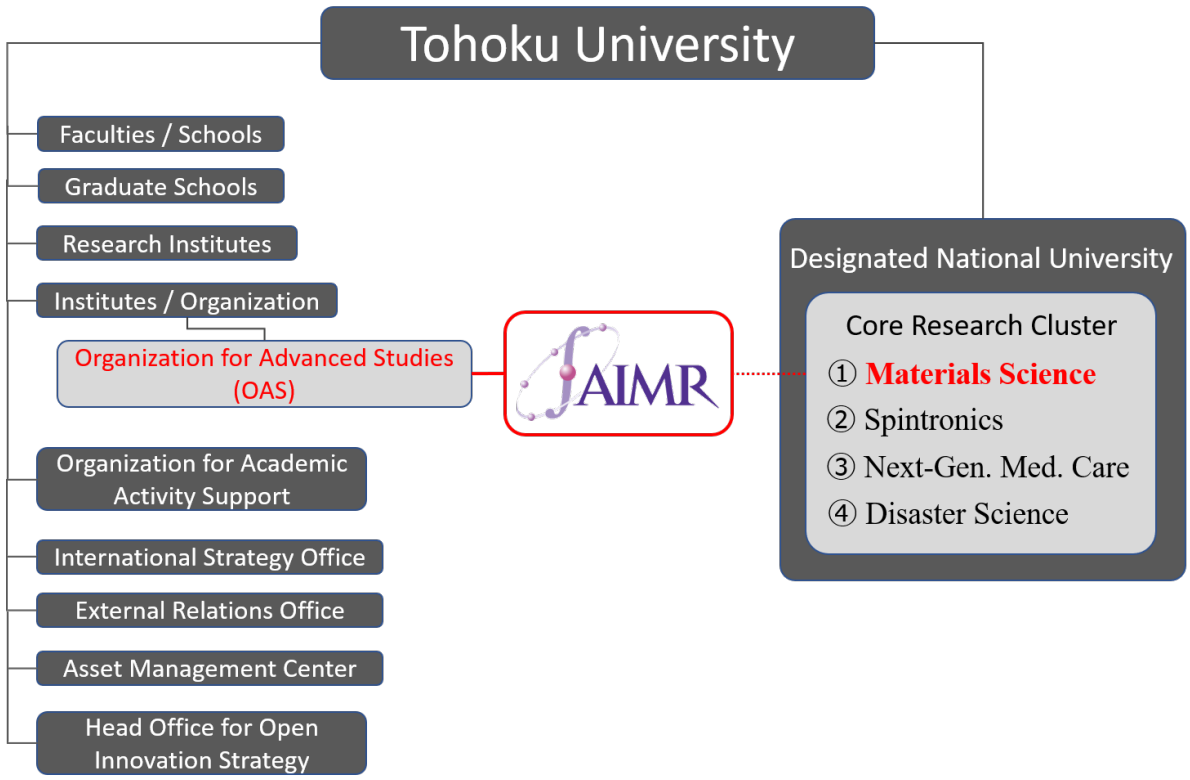


- "AIST-TohokuU Mathematics for Advanced Materials Open Innovation Laboratory (MathAM-OIL)" was established on June 30th, 2016, and "SUURI-COOL (Sendai)", a satellite office of RIKEN's iTHEMS, was established in 2018. These two organizations are also shown in this diagram though these two are not necessarily internal organizations of AIMR (researchers belonging to these two organizations concurrently have positions at AIMR).
- "Center of Mathematical Science for Open Innovation" was established on December 1st, 2019.
- AIMR is now reorganizing the AIMR Advisory Board by integrating the previous AIMR International Advisory Board and External Advisory Committee.
- On March 31st, 2020, Prof. Tadahiro Hayasaka retired from Executive Vice President for Research at the end of his term, and Prof. Motoko Kotani, the former Center Director of AIMR (and the current Director of OAS), will be appointed to the new Executive Vice President for Research of Tohoku University on April 1st, 2020.

6-2.

- Make a diagram of the organizational chart to show Center's position within the host institution.

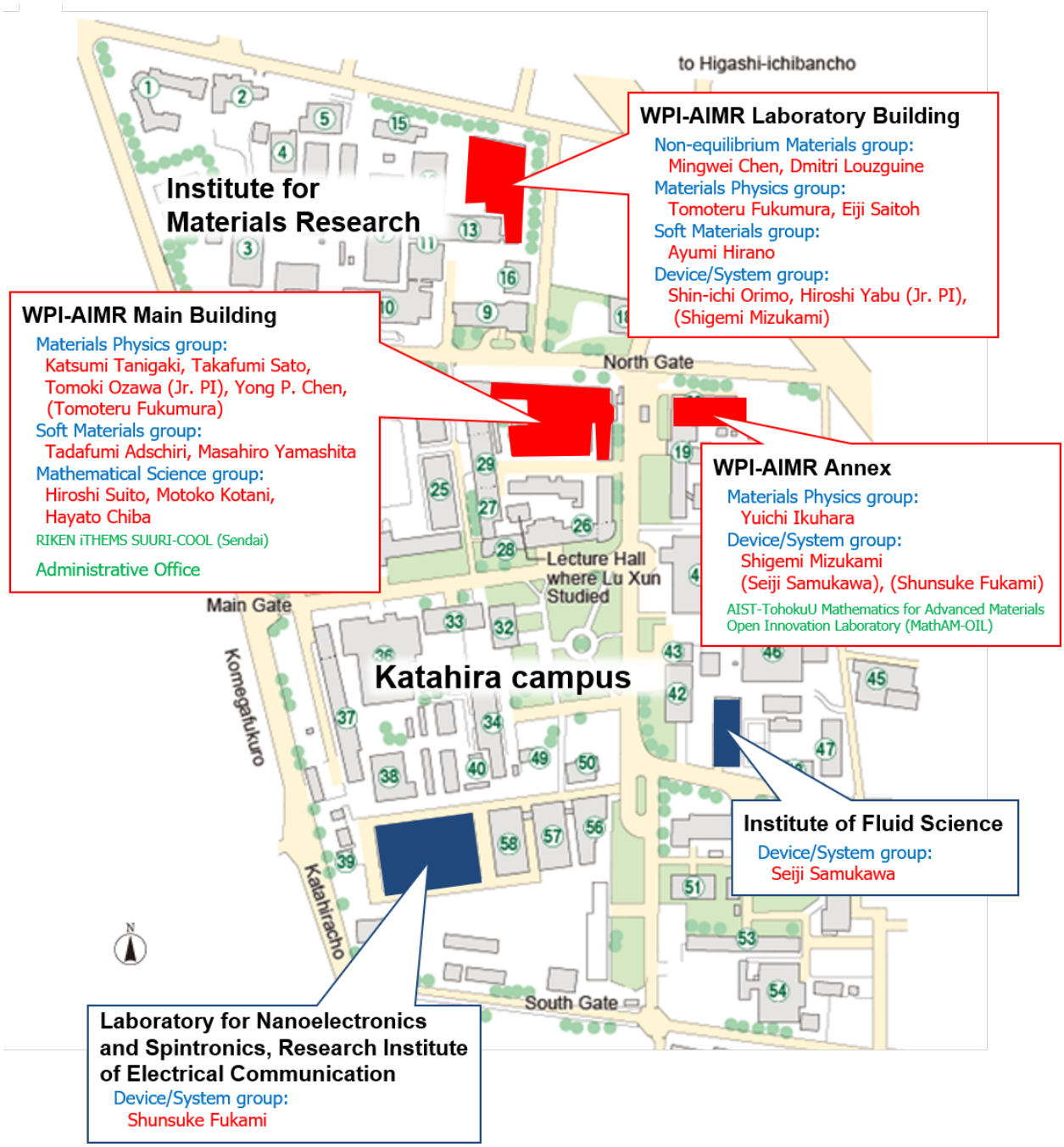
Position of AIMR in the Host Institution



7. Campus Map

- Draw a simple map of the campus showing where the main office and principal investigator(s) are located.

【Katahira Campus】



Appendix3-1a Number of Center Personnel FY2016-FY2019

	FY2016		FY2017		FY2018		FY2019	
	Number of persons	%	Number of persons	%	Number of persons	%	Number of persons	%
Researchers	137		101		109		105	
Overseas researchers	71	51.8%	45	44.6%	45	41.3%	38	36.2%
Female researchers	15	10.9%	8	7.9%	5	4.6%	6	5.7%
Principal investigators (PIs)	30		27		26		24	
Overseas PIs	13	43.3%	12	44.4%	11	42.3%	9	37.5%
Female PIs	2	6.7%	2	7.4%	2	7.7%	2	8.3%
Other researchers	52		38		49		58	
Overseas researchers	19	36.5%	9	23.7%	13	26.5%	14	24.1%
Female researchers	2	3.8%	1	2.6%	0	0.0%	1	1.7%
Postdocs	55		36		34		23	
Overseas Postdocs	39	70.9%	24	66.7%	21	61.8%	15	65.2%
Female Postdocs	11	28.2%	5	13.9%	3	8.8%	3	13.0%
Research support staffs	69		35		34		43	
Administrative staffs	22		35		21		20	
TOTAL	228		171		164		168	

Number of persons who were/have been paid using the host institution's operating budget (excluding indirect funding) among the above persons.

	FY2016	FY2017	FY2018	FY2019
Principal investigators (PIs)	10	19	19	16
Other researchers	3	26	22	29
Postdocs	0	8	6	3
Research support staffs	10	10	12	13
Administrative staffs	10	31	17	19

※ Make consistent with the number of persons reported in Appendix 3-2.

Changes vis-à-vis the Center's application for academy center certification

※ If changes have been made vis-à-vis the Center's application for academy center certification, describe the main changes and the reasons for them.

With respect to the number of persons who were/have been paid using the host institution's operating budget, it has been less than the number described in the initial plan (the application for academy center certification). However, due to a variety of efforts such as employment using external funds and utilization of cross-appointment system, AIMR has kept the total number of center personnel greater than that described in the plan.

Appendix 3-1b　Career Path of WPI Postdocs

Enter the information below during the period from the start of the center through the end of FY 2019.

- For each person, fill in the spaces to the right. More spaces may be added.
- Leave "Position as of April 2020" blank if unknown.

Japanese Postdocs

Employment period	Position before employed at WPI center		Next position after WPI center		Position as of April 2020*	
	Position title, organization	Country where the organization is located	Position title, organization	Country where the organization is located	Position title, organization	Country where the organization is located
2007.11.1 - 2009.2.28	Researcher, Inst. for Materials Research, Tohoku Univ.	JPN	Assistant Professor, Graduate School of Science, Tohoku Univ.	JPN	Senior Researcher, NISSAN ARC, LTD.	JPN
2007.11.16 - 2010.3.31	Researcher, Inst. of Multidisciplinary Research for Advanced Materials, Tohoku Univ.	JPN	Assistant Professor, New Industry Creation Hatchery Center, Tohoku Univ.	JPN	Senior Researcher, National Institute of Advanced Industrial Science and Technology (AIST)	JPN
2008.4.1 - 2011.3.31	Researcher, Graduate School of Engineering, The Univ. of Tokyo	JPN	Staff, Advanced Algorithm & Systems	JPN	Specially Appointed Associate Professor, Osaka Univ.	JPN
2008.4.1 - 2011.3.31	Researcher, Nagoya Univ.	JPN	Researcher, East Tokyo Laboratory, Genesis Research Inst., Inc.	JPN	Staff, Tokyo Electron Limited.	JPN
2008.4.1 - 2008.12.31	Researcher, Japan Atomic Energy Agency	JPN	Assistant Professor, Kyushu Inst. of Technology	JPN	Associate Professor, Kyushu Inst. of Technology	JPN
2008.4.1 - 2010.3.31	Ph.D. Student, Graduate School of Engineering, Tohoku Univ.	JPN	Researcher, TOSHIBA CORPORATION	JPN	Researcher, TOSHIBA CORPORATION	JPN

2008.4.1 - 2011.3.31	Researcher, Aaoyama Gakuin Univ.	JPN	Research Associate, Univ. of Virginia	USA	Associate Professor, Okayama Univ.	JPN
2008.5.1 - 2011.3.31	Researcher, Graduate School of Science, Tohoku Univ.	JPN	Researcher, TOSHIBA CORPORATION	JPN	Researcher, TOSHIBA CORPORATION	JPN
2009.4.1 - 2009.12.31	Ph.D. Student, The Univ. of Tokyo	JPN	Posdoc, Kyushu Univ.	JPN	Associate Professor, Univ. of Hyogo	JPN
2009.4.1 - 2011.3.31	Research Fellowship for Young Scientists, JSPS	JPN	Researcher, Kyushu Univ.	JPN	Specialist, KIOXIA Corporation	JPN
2010.1.20 - 2012.3.31	Researcher, Kyushu Univ.	JPN	Specially Appointed Assistant Professor, Kyushu Univ.	JPN	Specially Appointed Assistant Professor, Kyushu Univ.	JPN
2010.4.1 - 2013.3.31	Ph.D. Student, Graduate School of Engineering, Tohoku Univ.	JPN	Assistant Professor, Inst. for Materials Research, Tohoku Univ.	JPN	Assistant Professor, Inst. for Materials Research, Tohoku Univ.	JPN
2011.4.1 - 2012.6.30	Ph.D. Student, Graduate School of Science, Tohoku Univ.	JPN	Staff, Hitachi Global Storage Technologies	JPN	Staff, Tokyo Electron Limited.	JPN
2012.4.1 - 2014.3.31	Researcher, Hokkaido Univ.	JPN	Technical Staff, Chitose Inst. of Science and Technology	JPN	Assistant Professor, Asahikawa Medical University	JPN
2012.4.1 - 2013.5.31	Ph.D. Student, Chuo Univ.	JPN	Researcher, WPI-iCeMS, Kyoto Univ.	JPN	Assistant Professor, Hokkaido Univ.	JPN
2012.4.1 - 2012.7.31	Researcher, Tohoku Univ.	JPN	Assistant Professor, Graduate School of Engineering, Tohoku Univ.	JPN	Lecturer, Environment Conservation Center, Tohoku Univ.	JPN

2012.4.1 - 2013.9.30	Researcher, Italian Inst. of Technology	ITA	Assistant Professor, Waseda Univ.	JPN	Associate Professor (Lecturer), Tokyo Inst. of Technology	JPN
2012.5.1 - 2014.4.30	Researcher, Osaka Univ.	JPN	Staff, Tokyo Instruments, Inc.	JPN	Assistant Professor, High Energy Accelerator Research Organization (KEK)	JPN
2012.5.1 - 2015.3.31	Project Researcher, The Univ. of Tokyo	JPN	Project Researcher, Graduate School of Arts and Sciences, The Univ. of Tokyo	JPN	Chief Technology Officer, Sigma-i Co., Ltd. / Specially Appointed Associate Professor, Graduate School of Information Sciences, Tohoku Univ.	JPN
2013.4.1 - 2016.3.31	Specially Appointed Researcher/Fellow, Graduate School of Engineering, Osaka Univ.	JPN	Researcher, Natoinal Inst. of Advanced Industrial Science & Technology (AIST)	JPN	Researcher, Natoinal Inst. of Advanced Industrial Science & Technology (AIST)	JPN
2013.4.1 - 2014.3.31	Assistant Professor, Kochi Univ. of Technology	JPN	Associate Professor, Doshisha Univ.	JPN	Associate Professor, Kindai Univ.	JPN
2014.8.1 - 2016.3.31	Researcher, Inst. for Materials Research, Tohoku Univ.	JPN	Researcher, Inst. for Materials Research, Tohoku Univ.	JPN	Researcher, Samsung R&D Institute Japan	JPN
2011.4.1 - 2016.3.15	Ph.D. Student, The Univ. of Tokyo	JPN	Contract Lecturer, Tokyo Inst. of Technology	JPN	Associate Professor, Tokyo Inst. of Technology	JPN

2011.10.1 - 2015.9.30	Postdoctoral Fellowship for Research Abroad, JSPS	JPN	Associate Professor, Kanazawa Univ.	JPN	Associate Professor, WPI-NanoLSI, Kanazawa Univ.	JPN
2009.12.1 - 2012.8.31	Research Fellowship for Young Scientists, JSPS	JPN	Assistant Professor, Graduate School of Science, Tohoku Univ.	JPN	Associate Professor, Okayama Univ. of Science	JPN
2008.4.1 - 2015.4.30	Researcher, Inst. of Materials Structure Science, High Energy Accelerator Research Organization	JPN	Researcher, RIKEN SPring-8 Center, RIKEN	JPN	Program-Specific Associate Professor, Office of Society-Academia Collaboration for Innovation, Kyoto Univ.	JPN
2008.4.1 - 2015.3.31	Ph.D. Student, Graduate School of Engineering, Tohoku Univ.	JPN	Project Associate Professor, Graduate School of Engineering, Tohoku Univ.	JPN	Project Associate Professor, Graduate School of Engineering, Tohoku Univ.	JPN
2015.7.1 - 2015.10.31	Technical Staff, New Industry Creation Hatchery Center (NICHe), Tohoku Univ.	JPN	Research Associate, AIMR/UChicago Joint Research Center, The Univ. of Chicago	USA	Assistant Professor, New Industry Creation Hatchery Center (NICHe), Tohoku Univ.	JPN
2016.10.1 - 2017.3.31	Special Topic Researcher, Japan Atomic Energy Agency	JPN	Special Topic Researcher, Japan Atomic Energy Agency	JPN	Senior Researcher, Takasaki Advanced Radiation Research Inst., National Inst. for Quantum and Radiological Science and Technology	JPN
2012.6.1 - 2017.3.31	Researcher, National Chiao Tung University	TWN	Visiting Scientist, Graduate School of Science, Tohoku Univ.	JPN	Consultant, Tecnos Data Science Engineering, Inc.	JPN
2017.4.1 - 2018.1.31	Project Assistant Professor, Kyusyu Univ.	JPN	Researcher, Hokuetsu Corporation	JPN		

2017.7.1 - 2018.3.31	Research Associate, Micro System Integration Center, Tohoku Univ.	JPN	Researcher, Micro System Integration Center, Tohoku Univ.	JPN		
2017.4.1 - 2018.5.31	Postdoc., Chinese Academy of Sciences	CHN	Researcher, Center for High Pressure Science and Technology Advanced Research (HPSTAR)	CHN	Researcher, Center for High Pressure Science and Technology Advanced Research (HPSTAR)	CHN
2015.4.1 - 2016.6.30	Ph.D. Student, The Univ. of Tokyo	JPN	Assistant Professor, Graduate School of Science, Tohoku Univ.	JPN	Assistant Professor, Graduate School of Science, Tohoku Univ.	JPN
2012.5.1 - 2017.3.31	Ph.D. Student, The Univ. of Tokyo	JPN	Special Postdoctoral Researcher, RIKEN	JPN	Specially Appointed Assistant Professor, Inst. for Materials Research, Tohoku Univ.	JPN
2018.10.1 - 2019.3.31	Ph.D. Student, Graduate School of Environmental, Tohoku Univ.	JPN	Assistant Professor, Frontier Research Institute for Interdisciplinary Sciences, Tohoku Univ.	JPN	Assistant Professor, Frontier Research Institute for Interdisciplinary Sciences, Tohoku Univ.	JPN
2018.10.1 - 2020.3.31	Research Fellowship for Young Scientists, JSPS	JPN	Assistant Professor, Graduate School of Engineering, Tohoku Univ.	JPN	Assistant Professor, School of Engineering, Tohoku Univ.	JPN

Overseas Postdocs

Employment period	Position before employed at WPI center		Next position after WPI center		Position as of April 2020*		Nationality
	Position title, organization	Country where the organization is located	Position title, organization	Country where the organization is located	Position title, organization	Country where the organization is located	
2008.4.1 - 2008.6.30	Researcher, Inst. for Materials Research, Tohoku Univ.	JPN	Research Associate, Univ. of Nevada	USA	Professor, Huazhong Univ. of Science and Technology	CHN	CHN
2008.4.1 - 2009.6.30	Researcher, Graduate School of Science, Tohoku Univ.	JPN	Assistant Professor, WPI-iCeMS, Kyoto Univ.	JPN	Research Associate, University of Calgary	CAN	CHN
2008.7.1 - 2009.5.31	Ph.D. Student, Dilian Univ. of Technology	CHN	Postdoc, National Research Council Canada	CAN	Research officer, National Research Council Canada	CAN	CHN
2008.7.12 - 2011.3.31	Ph.D. Student, Inst. of Chemistry, Chinese Academy of Sciences	CHN	Postdoc, RIKEN	JPN			CHN
2008.7.21 - 2011.12.31	Researcher, Intl. Advanced Research Center for Power Metallurgy and New Materials	IND	Scientist, National Metallurgical Laboratory	IND	Associate Professor, Indian Inst. of Technology Jammu	IND	IND
2008.8.2 - 2011.3.31	Ph.D. Student, China Iron & Steel Research Inst. Group	CHN	Postdoc Fellow, The Johns Hopkins Univ.	USA	Professor, Beijing Computational Science Research Center	CHN	CHN
2008.9.11 - 2011.9.10	Ph.D. Student, Inst. of Chemistry, Chinese Academy of Sciences	CHN	Research Associate, Graduate School of Pharmaceutical Science, Tohoku Univ.	JPN	Associate Professor, Qingdao Inst. of Bioenergy and Bioprocess Technology, Chinese Academy of Sciences	CHN	CHN
2008.10.20 - 2010.11.5	Ph.D. Student, Complutense Univ.	ESP	Researcher, Autonomaous Univ. of Barcelona	ESP	Senior Lecturer, Northumbria Univ.	GBR	ESP

2008.11.26 - 2009.8.31	Postdoc, The Univ. of Texas at Austin	USA	Postdoc, Chungnam National Univ.	KOR	Principal Researcher, Samsung Advanced Inst. of Technology	KOR	KOR
2008.12.1 - 2009.11.30	Researcher, WPI-AIMR, Tohoku Univ.	JPN	Assistant Professor, Univ. of Nevada	USA			CHN
2009.1.14 - 2010.9.30	Ph.D. Student, Graduate School of Engineering, Tohoku Univ.	JPN	COE Fellow, Inst. of Fluid Science, Tohoku Univ.	JPN	Senior Lecturer, Univ. of Lincoln	GBR	IND
2009.4.1 - 2010.3.31	Research Associate, Indian Inst. of Science	IND	Staff, Department of Physics, Indian Inst. of Science	IND			IND
2009.5.13 - 2009.8.31	Senior Researcher, Ural State Univ.	RUS	Researcher, Inst. of Applied Acoustics	RUS			RUS
2009.8.27 - 2013.3.31	Ph.D. Student, Univ. of Science & Technology of China	CHN	Associate Professor, Ningbo Inst. of Materials Technology and Engineering, Chinese Academy of Sciences	CHN	Professor, Ningbo Inst. of Materials Technology and Engineering, Chinese Academy of Sciences	CHN	CHN
2009.10.1 - 2011.3.31	Research Scientist, Max-Planck Inst. for Metals Research	DEU	Professor, Inst. of Physics, Chinese Academy of Sciences	CHN	Professor, Inst. of Physics, Chinese Academy of Sciences	CHN	CHN
2009.10.1 ~ 2011.11.25	Postdoc, Tohoku Univ.	JPN	Research Scientist, Inst. of Microelectronics	SGP	Research Scientist, VTT (Technical Research Centre of Finland Ltd)	FIN	KOR
2009.10.29 - 2011.6.30	JSPS Postdoctoral Fellowship for Foreign Researchers	JPN	Professor, Jilin Univ.	CHN	Professor, Jilin Univ.	CHN	CHN

2009.11.1 - 2011.4.30	Researcher, Universität Ulm	DEU	Research Associate, Leibniz Inst. for New Materials	DEU	Assistant Professor, Korea Univ. of Technology and Education (KOREATECH)	KOR	FRA
2009.11.5 - 2014.3.31	Ph.D. Student, Changchun Inst. Of Applied Chemistry, Chinese Academy of Sciences	CHN	Lecturer, Zhengzhou Univ.	CHN	Lecturer, Zhengzhou Univ.	CHN	CHN
2009.11.15 - 2010.4.30	Postdoctoral Researcher, National Inst. for Materials Science (NIMS)	JPN	Assistant Professor, Inst. of Metal Research, Chinese Academy of Sciences	CHN			CHN
2010.1.12 - 2012.3.31	Researcher, Tohoku Univ.	JPN	JSPS Postdoctoral Fellowship for Foreign Researchers	JPN			BRA
2010.1.25 - 2011.3.31	Postdoc, Univ. of Alabama	USA	Research Associate, Clausthal Univ. of Technology	DEU	Lecturer, Brunel Univ. London	GBR	IND
2010.3.16 - 2011.3.31	Assistant Professor, College of Engineering, King Saud Univ.	SAU	Assistant Professor, Graduate School of Science, Tohoku Univ.	JPN	Associate Professor, Solar Energy Research Inst., The National Univ. of Malaysia	MYS	BGD
2010.3.24 - 2011.4.12	Postdoctoral Staff Researcher, Toyota Technical Center, Materials Research Department	USA	Researcher, North Carolina State Univ.	USA			USA
2010.4.1 - 2011.2.15	Project Researcher, Graduate School of Medicine, The Univ. of Tokyo	JPN	Technical Staff, Okinawa Inst. of Science & Technology Graduate Univ. (OIST)	JPN	Business Development Manager, Decode Science Pty. Ltd.	AUS	IRN

2010.4.1 - 2011.2.28	Research Assistant, Max-Planck Inst. For Solid State Research	DEU	Postdoc, RIKEN	JPN	Researcher, RIKEN	JPN	DEU
2010.6.24 - 2010.12.24	Assistant Professor, Inst. of Semiconductors, Chinese Academy of Sciences	CHN	Assistant Professor, Inst. of Semiconductors, Chinese Academy of Sciences	CHN			CHN
2010.7.12 - 2013.3.31	Assistant Professor, Tianjin Polytechnic Univ.	CHN	Assistant Professor, Tianjin Polytechnic Univ.	CHN	Professor, Tianjin Polytechnic Univ.	CHN	CHN
2010.11.1 - 2013.3.31	Ph.D. Student, Chinese Academy of Sciences	CHN	Postdoc, Univ. of Wisconsin –Madison	USA	Professor, Ningbo Inst. of Materials Technology and Engineering, Chinese Academy of Sciences	CHN	CHN
2010.11.24 - 2014.11.23	Researcher, CNRS	FRA	Researcher, Aix-Marseille Univ.	FRA	Researcher, Aix-Marseille Univ.	FRA	FRA
2010.12.1 - 2011.8.31	Research Associate, The Univ. of Melbourne	AUS	Postdoc Research Fellow, Aarhus Univ.	DNK	Lecturer, Monash University	AUS	SGP

2010.12.1 - 2013.3.31	Research Associate, National Univ. of Science & Technology (MISIS)	RUS	Associate Professor (department of material physics) and Research Associate (Scientific and Research Center of Composite Materials) of the National Univ. of Science and Technology (MISIS)	RUS	Postdoc, Erich Schmid Inst. of Materials Science of the Austrian Academy of Sciences and Associate Professor (department of material physics) and Research Associate (Scientific and Research Center of Composite Materials) of MISIS	AUT & RUS	RUS
2011.1.18 - 2012.5.31	Researcher, Univ. of Texas	USA	Associate Professor, Shanghai Inst. of Metaria Medica, Chinese Academy of Sciences	CHN	Independent Principle Investigator and Professor, Shanghai Inst. of Materia Medica, Chinese Academy of Sciences	CHN	CHN
2011.2.1 - 2011.10.31	Postdoc, National Inst. for Materials Science (NIMS)	JPN	JSPS Postdoctoral Fellowship for Foreign Researchers	JPN			CHN
2011.7.1 - 2013.6.30	Ph.D. Student, Inst. of Chemistry, Chinese Academy of Sciences	CHN	Researcher, Ulsan National Inst. of Science and Technology	KOR			CHN
2011.7.1 - 2013.8.31	Ph.D. Student, Shandong Univ.	CHN	Teacher, Southwest Petroleum Univ.	CHN	Associate Professor, Southwest Petroleum Univ.	CHN	CHN
2011.7.14 - 2015.3.23	Ph.D. Student, Inst. of Physics, Chinese Academy of Sciences	CHN	Postdoc, Johns Hopkins Univ.	USA	Research Staff Member, HFC Semiconductor Corp.	USA	CHN

2011.10.1 - 2012.3.31	Ph.D. Student, Hong Kong Univ. of Sci. & Tech.	CHN	Associate Professor, Sun Yat-sen Univ.	CHN	Professor, Sun Yat-sen Univ. (Visiting Scientist, Harvard Medical School, USA)	CHN	CHN
2012.1.1 - 2014.7.31	Researcher, Micro System Integration Center, Tohoku Univ.	JPN	Researcher, MEMS CORE Co., Ltd.	JPN	Assistant Professor, National Chung Hsing Univ.	TWN	TWN
2012.2.1 - 2012.3.31	Researcher, UCL	GBR	Research Associate, UCL	GBR	Nottingham Research Fellow, The Univ. of Nottingham	GBR	CHN
2012.2.3 - 2014.3.31	Postdoctoral Research Fellow, McMaster Univ.	CAN	Assistant Professor, Inst. of Technology Bandung	IDN	Lecturer, Universitas Trisakti	IDN	IDN
2012.4.1 - 2014.4.30	Ph.D. Student, Nagoya Univ.	JPN	Postdoc., Dankook Univ.	KOR	Research Associate, Oregon Health and Science Univ.	USA	IND
2012.5.1 - 2013.3.31	Researcher, Pusan Nationl Univ.	KOR	Researcher, Inst. of Multidisciplinary Research for Advanced Materials, Tohoku Univ.	JPN			KOR
2012.9.1 - 2014.3.31	Ph.D. Student, Nankai Univ.	CHN	Research Fellow, Nanyang Technology Univ.	SGP	Professor, Univ. of Electronic Science and Technology of China	CHN	CHN
2012.9.1 - 2015.2.28	Ph.D. Student, Donghua Univ.	CHN	Researcher, Ningbo Inst. of Industrial Technology, CAS / Ningbo Fu materials Co. Ltd.	CHN			CHN

2012.9.16 - 2016.3.31	PhD. Student, Pisa Univ.	ITA	Researcher, Kyushu Univ.	JPN	Researcher, Tokyo Inst. of Technology	JPN	VNM
2012.10.9 - 2015.1.31	Ph.D. Student, Tampere Univ. of Technolog	FIN	Science Fellow, Aalto Univ.	FIN	Co-founder and Scientific Director of Nanolayers Research Computing Ltd. and Visiting Scientist at Aalto Univ.	GBR & FIN	ITA
2012.11.3 - 2013.11.2	Researcher, Univ. of Cambridge	GRB	Research Associate, Univ. of Cambridge	GBR	Researcher, Leibniz Inst. for Solid State and Materials Research Dresden	DEU	CZE
2012.12.1 - 2014.9.15	Ph.D. Student, Technische Universität Berlin	DEU	Chemist, BASF-the Chemical Company	DEU	Process Manager in Hazardous Waste Incineration, BASF	DEU	FRA
2012.12.1 - 2013.11.30	Researcher, Nanoco Technologies Ltd.	GBR	Research Associate, Univ. of Cambridge	GBR	Senior Consultant, Element Energy	GBR	GBR
2013.1.15 - 2014.1.14	JSPS Postdoctoral Fellowship for Foreign Researchers	JPN	Postdoc Research Fellow, National Inst. for Materials Science (NIMS)	JPN	Professor, Sichuan Univ.	CHN	CHN
2013.3.18 - 2014.12.31	Researcher, Univ. of California, Santa Barbara	USA	Postdoc, Rice Univ.	USA	Professor, Univ. of Electronic Science and Technology of China	CHN	CHN
2013.4.1 - 2015.3.31	Researcher, Research Inst. of Electrical Communication, Tohoku Univ.	JPN	Postdoc, Regensburg Univ.	DEU	Postdoc, Regensburg Univ.	DEU	CHN
2013.7.26 - 2014.7.25	Ph.D. Student, Aix-Marseille Univ.	FRA	Postdoc, Unité Mixte de Physique, CNRS/Thales	FRA			FRA

2013.10.1 - 2015.8.30	Ph.D. Student, Peking Univ.	CHN	Lecturer, North China Electric Power Univ.	CHN	Associate professor, North China Electric Power Univ.	CHN	CHN
2013.10.3 - 2015.1.31	Researcher, Inst. for Energy Technology	NOR	Research Associate, Curtin Univ.	AUS	Research Fellow, Curtin Univ.	AUS	GBR
2013.11.1 - 2014.7.31	Ph.D. Student, Univ. of Zurich	CHE	Research Scientist, Philochem AG	CHE	Project Leader, Philochem AG	CHE	ITA
2014.4.1 - 2015.10.31	Ph.D. Student, Graduate School of Science, Tohoku Univ.	JPN	Researcher, Tokyo Inst. of Technology	JPN	Assistant Professor, Tokyo Inst. of Technology	JPN	CHN
2014.4.1 - 2016.3.31	Ph.D. Student, Graduate School of Engineering, Tohoku Univ.	JPN	Researcher, Inst. for Materials Research, Tohoku Univ.	JPN	Specially Appointed Assistant Professor, Inst. for Materials Research, Tohoku Univ.	JPN	CHN
2015.1.1 - 2015.9.30	Ph.D. Student, Graduate School of Engineering, Osaka Univ.	JPN	Specially Appointed Assist. Prof., Osaka Univ.	JPN			VNM
2015.4.1 - 2016.2.29	Posdoc, Universite Lille Nord de France, CNRS	FRA	Assistant Professor, Changchun Inst. of Applied Chemistry, Chinese Academy of Sciences	CHN	Research Associate, Changchun Inst. of Applied Chemistry, Chinese Academy of Sciences	CHN	CHN
2011.4.2 - 2015.6.30	Ph.D. Student, Graduate School of Engineering, Tohoku Univ.	JPN	Research Fellow, Univ. of Toronto	CAN	Assistant Professor at Terasaki Inst., Univ. of California, Los Angeles	USA	IRN

2011.4.1 - 2014.4.30	Researcher, Univ. of Hyogo	JPN	Assistant Professor, Inst. of Advanced Chemistry of Catalonia (IQAC) at Spanish Council for Scientific Research (CSIC)	ESP	Professor, Catalan Institution for Research and Advanced Studies (ICREA)	ESP	ESP
2008.5.1 - 2015.9.25	Research Scientist, Honey Well Company	USA	Professor, Beijing Univ. of Chemical Technology	CHN	Professor, Beijing Univ. of Chemical Technology	CHN	CHN
2010.10.14 - 2015.2.28	Ph.D. Student, South CHN Univ. of Technology	CHN	Professor, South China Univ. of Technology	CHN	Professor, South China Univ. of Technology	CHN	CHN
2011.2.15 - 2014.7.22	Researcher, The Hong Kong Polytechnic Univ.	HKG	Professor, Huazhong Univ. of Science and Technology	CHN	Professor, Huazhong Univ. of Science and Technology	CHN	CHN
2010.4.1 - 2014.10.31	Postdoc, Inst. for Materials Chemistry and Engineering, Kyushu Univ.	JPN	Professor, Northeastern Univ.	CHN	Professor, Northeastern Univ.	CHN	CHN
2008.9.1 - 2014.3.31	Ph.D. Student, Tsinghua Univ.	CHN	Research Associate Professor, Tsinghua Univ.	CHN	Associate Professor, Tsinghua Univ.	CHN	CHN
2007.12.13 - 2015.7.31	Research Lecturer, School of Electronics Engineering, Korea Univ.	KOR	Professor, East China Univ. of Science and Technology	CHN	Professor, East China Univ. of Science and Technology	CHN	CHN
2012.4.1 - 2016.7.31	Ph.D. Student, Chinese Academy of Sciences	CHN	Lecturer, Beijing Univ. of Technology	CHN	Associate Professor, Beijing Univ. of Technology	CHN	CHN
2014.10.1 - 2016.10.31	Researcher, WPI-AIMR, Tohoku Univ.	JPN	Professor, South China Univ. of Technology	CHN	Professor, South China Univ. of Technology	CHN	CHN

2014.4.1 - 2017.1.15	Postdoctoral Researcher, Ewha Womans Univ.	KOR	Assistant Professor, Manipal University	IND	Postdoctoral Researcher, WPI-ICReDD, Hokkaido Univ.	JPN	IND
2016.4.1 - 2017.1.31	Ph.D. Student, Comenius Univ.	SVK	Postdoc, Toyota Technological Inst.	JPN	Researcher, Paul Scherrer Inst. (PSI)	CHE	SVK
2015.1.5 - 2017.3.31	Research Associate, Northeastern Univ.	USA	Professor, Southwest Univ.	CHN	Professor, Southwest Univ.	CHN	IND
2014.9.1 - 2017.3.31	Postdoc. Fellowship, German Textile Research Inst. North-West Krefeld	DEU	Postdoc, Chair of Biomaterials, Univ. of Bayreuth	DEU	Group Leader, Chair of Biomaterials, Univ. of Bayreuth	DEU	IRN
2013.10.1 - 2017.3.31	Researcher, WPI-AIMR, Tohoku Univ.	JPN	Professor, Hunan Univ.	CHN	Professor, Hunan Univ.	CHN	CHN
2016.4.1 - 2017.3.31	Researcher, WPI-AIMR, Tohoku Univ.	JPN	Postdoc, Max Planck Inst. for Chemical Physics of Solids	DEU			IRN
2015.10.1 - 2017.3.31	Researcher, Yamaguchi Univ.	JPN	Postdoc, Univ. of Toronto	CAN	Postdoc, Univ. of Toronto	CAN	IRN
2015.10.1 - 2017.3.31	Research Associate, Jilin Univ.	CHN	Researcher, WPI-AIMR, Tohoku Univ.	JPN	Professor, Jilin Univ.	CHN	CHN
2012.8.1 - 2017.3.31	Ph.D. Student, Beijing Univ. of Technology	CHN	Associate Professor, Shanghai Jiao Tong Univ.	CHN	Associate Professor, Shanghai Jiao Tong Univ.	CHN	CHN
2015.5.1 - 2017.3.31	Researcher, Osaka Univ.	JPN	Research Fellow, National Univ. of Singapore	SGP			CHN
2015.5.1 - 2017.3.31	Postdoc, Aristotle Univ. of Thessaloniki	GRE	Senior Researcher, Central European Inst. of Technology (CEITEC)	CZE	Senior Researcher, Central European Inst. of Technology (CEITEC)	CZE	CYP

2015.4.1 - 2017.3.31	Ph.D. Student, Univ. Bremen	DEU	Postdoc, Univ. of Alberta	CAN	Postdoc, Univ. of Bern	CHE	IRN
2011.11.1 - 2017.3.31	Senior Researcher, Moscow State Inst. of Steel and Alloys	RUS	Senior Research Associate, Erich Schmid Inst. of Materials Science of the Austrian Academy of Sciences	AUT	Senior PostDoc, Erich Schmid Inst. of Materials Science of the Austrian Academy of Sciences	AUT	RUS
2015.3.1 - 2017.3.31	Research Associate, Indian Inst. of Technology	IND	Postdoc, Center for Innovative Integrated Electronic Systems, Tohoku Univ.	JPN	Program-Specific Assistant Professor, Kyoto Univ.	JPN	IND
2015.5.1 - 2017.8.31	Researcher, Inst. for Materials Research, Tohoku Univ.	JPN	Researcher, SEMES	KOR			KOR
2016.2.1 - 2017.12.31	Postdoc, Ohio Univ.	USA	University Assistant, Graz Univ. of Technology	AUT	University Assistant, Graz Univ. of Technology	AUT	FRA
2017.4.1 - 2018.3.31	Postdoc., Ruder Boskovic Inst.	CRO	Research Associate, Rudjer Boskovic Inst.	CRO	Research Associate, Rudjer Boskovic Inst.	CRO	CRO
2016.7.1 - 2018.3.31	Engineer, Hanergy Holding Group Limited	CHN	Assistant Professor, Kochi Univ. of Technology	JPN	Professor, Qufu Normal Univ.	CHN	CHN
2016.4.1 - 2018.3.31	Research Fellowship for Young Scientists, JSPS	JPN	Lecturer, Shanghai Univ.	CHN	Lecturer, Shanghai Univ.	CHN	CHN
2016.4.1 - 2018.3.31	Ph.D. Student, Kyusyu Univ.	JPN	Postdoc, RIKEN / Special Appointed Researcher, Kyoto Univ. Insti. for Advanced Study	JPN	Postdoc, RIKEN / Special Appointed Researcher, Kyoto Univ. Insti. for Advanced Study	JPN	PHL

2017.4.1 - 2018.3.31	Ph.D. Student, Graduate School of Engineering, Tohoku Univ.	JPN	Researcher, Research Center, Asahi Glass Co., Ltd.	JPN	Researcher, Research Center, AGC Inc.	JPN	CHN
2017.4.17 - 2018.4.16	Research Associate, Max Planck Inst.	DEU	Head of Group Sustainable Catalytic Materials, Hydrogen Technologies, Fraunhofer Institute for Solar Energy Systems ISE	DEU	Head of Group Sustainable Catalytic Materials, Hydrogen Technologies, Fraunhofer Institute for Solar Energy Systems ISE	DEU	DEU
2016.9.1 - 2018.9.30	Visiting Scientist, WPI-AIMR, Tohoku Univ.	JPN	Postdoc. Research Associate, Ulasn National Inst. of Science & Technology	KOR	Postdoc, King Abdullah Univ. of Science and Technology (KAUST)	SAU	CHN
2018.4.1 - 2019.3.31	Postdoc., Univ. of Nebraska-Lincoln	USA	Lecturer, Tianjin Univ.	CHN	Lecturer, Tianjin Univ.	CHN	CHN
2017.8.1 - 2019.10.3	Postdoc, National Dong Hwa University	TWN	Research Fellow, Univ. of Southampton	GBR	Research Fellow, Univ. of Southampton	GBR	IDN
2010.4.1 - 2016.12.31	Ph.D. Student, Graduate School of Engineering, Tohoku Univ.	JPN	Specially-appointed Assistant Professor, Graduate School of Engineering, Tohoku Univ.	JPN	Specially-appointed Assistant Professor, Graduate School of Engineering, Tohoku Univ.	JPN	IND
2017.4.1 - 2020.1.31	Ph.D. Student, Graduate School of Engineering, Tohoku Univ.	JPN	Assistant Professor, Frontier Research Inst. for Interdisciplinary Sciences, Tohoku Univ.	JPN	Assistant Professor, Frontier Research Inst. for Interdisciplinary Sciences, Tohoku Univ.	JPN	CHN

Project Expenditures FY2016

（Thousand yens）

	Amount	Details	Operational subsidies to National University Corporations/Incorporated Administrative Agency		Funding by WPI Academy		Government Subsidies except Funding from WPI Academy		Donations		Indirect funding		Joint research projects		Competitive funding		Others	
			Total costs	Details (no. of persons)	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details
Personnel	227,690	Operational subsidies to National University Corporations/Incorporated Administrative Agency	11,082	Center director 1			3,027	Center director										
	-	Funding by WPI Academy		Administrative director			8,427	Administrative director 1										
	723,843	Government Subsidies except Funding from WPI Academy	105,467	Principal investigators 9	-	Principal investigators 0	94,296	10	-	0	-	0	-	0	-	0	-	0
	-	Donations	71,901	・Full-time／Japanese 6		・Full-time／Japanese	62,000	・Full-time／Japanese 6										
	-	Indirect funding	14,856	・Concurrent／Japanese 2		・Concurrent／Japanese	5,731	・Concurrent／Japanese 2										
	-	Joint research projects	18,710	・Full-time／Overseas 1		・Full-time／Overseas	26,565	・Full-time／Overseas 2										
	-	Competitive funding	-	・Concurrent／Overseas 0		・Concurrent／Overseas	-	・Concurrent／Overseas 0										
	-	Others	31,685	Other researchers 3	-	Other researchers 0	341,067	Other researchers 46	-	0	-	0	-	0	-	0	-	0
			31,685	・Associate professor /Assistant professor 3		・Associate professor /Assistant professor	341,067	・Associate professor /Assistant professor 46										
			-	・Others 0		・Others		・Others										
			-	Postdocs 0		Postdocs	113,676	Postdocs 32										
			7,167	Research support staffs 10		Research support staffs	114,070	Research support staffs 26										
			72,289	Administrative staffs 10		Administrative staffs	49,280	Administrative staffs 36										
Subtotal	951,533		227,690	33	-	0	723,843	151	-	0	-	0	-	0	-	0	-	0
Project activities	39,317	Operational subsidies to National University Corporations/Incorporated Administrative Agency	110	Honorarium			12,571	Honorarium for invited PIs, etc.										
	-	Funding by WPI Academy					25,449	Costs for maintaining satellites										
	438,640	Government Subsidies except Funding from WPI Academy					77,428	Costs for start-up										
	-	Donations					27,993	Costs for fusion research										
	-	Indirect funding					23,702	Costs for Target Projects										
	-	Joint research projects					36,764	Costs to hold international symposia										
	-	Competitive funding	19,217	Expenses for consumables			48,093	Expenses for consumables										
	-	Others	3,417	Light, heating and water utility costs			59,195	Light, heating and water utility costs										
			16,573	Others			127,445	Others										
Subtotal	477,957		39,317		-		438,640		-		-		-		-		-	
Travel	2,894	Operational subsidies to National University Corporations/Incorporated Administrative Agency	1,233	Domestic travel expenses			1,360	Domestic travel expenses										
	-	Funding by WPI Academy	1,661	Overseas travel expenses			7,210	Overseas travel expenses										
	30,373	Government Subsidies except Funding from WPI Academy					9,640	Travel expenses for G13 Lab Program										
	-	Donations					12,031	Travel expenses for inviting guests										
	-	Indirect funding					132	Personal transfer allowance										
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	33,267		2,894		-		30,373		-		-		-		-		-	
Equipment	6,245	Operational subsidies to National University Corporations/Incorporated Administrative Agency	6,245	Costs for facilities/equipment			48,245	Costs for facilities/equipment										
	-	Funding by WPI Academy																
	48,245	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	-	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	54,490		6,245		-		48,245		-		-		-		-		-	
Research projects	56,970	Operational subsidies to National University Corporations/Incorporated Administrative Agency	56,970						38,919				134,280		374,222	KAKENHI	593,108	Others
	-	Funding by WPI Academy													1,157,453	Consigned research funds (JST, others)		
	-	Government Subsidies except Funding from WPI Academy																
	38,919	Donations																
	-	Indirect funding																
	134,280	Joint research projects																
	1,531,675	Competitive funding																
	593,108	Others																
Subtotal	2,354,952		56,970		-		-		38,919		-		134,280		1,531,675		593,108	
Others	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency																
	-	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	-	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	-		-		-		-		-		-		-		-		-	
Total	3,872,199		333,116		-		1,241,101		38,919		-		134,280		1,531,675		593,108	

Operational subsidies to National University Corporations/Incorporated Administrative Agency	運営費交付金
Funding by WPI Academy	WPIアカデミー国際頭脳循環の加速・拡大事業
Government Subsidies except Funding from WPI Academy	機関補助金（WPIアカデミー国際頭脳循環の加速・拡大事業を除く
Donations	寄付金
Indirect funding	間接経費
Joint research projects	共同研究費
Competitive funding	競争的資金
Others	その他

Project Expenditures FY2017

（Thousand yens）

	Amount	Details	Operational subsidies to National University Corporations/Incorporated Administrative Agency		Funding by WPI Academy		Government Subsidies except Funding from WPI Academy		Donations		Indirect funding		Joint research projects		Competitive funding		Others	
			Total costs	Details (no. of persons)	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details
Personnel	513,072	Operational subsidies to National University Corporations/Incorporated Administrative Agency	15,905	Center director 1														
	5,124	Funding by WPI Academy	8,326	Administrative director 1														
	23,673	Government Subsidies except Funding from WPI Academy	172,303	Principal investigators 18	-	Principal investigators 0	-	0	-	0	-	0	-	0	-	0	-	0
	-	Donations	127,572	・Full-time／Japanese 11		・Full-time／Japanese												
	3,101	Indirect funding	17,572	・Concurrent／Japanese 3		・Concurrent／Japanese												
	-	Joint research projects	24,167	・Full-time／Overseas 2		・Full-time／Overseas												
	-	Competitive funding	2,992	・Concurrent／Overseas 2		・Concurrent／Overseas												
	-	Others	134,381	Other researchers 26	4,931	Other researchers 5	-	0	-	0	-	0	-	0	-	0	-	0
			134,381	・Associate professor /Assistant professor 26	4,931	・Associate professor /Assistant professor 5												
			-	・Others	-	・Others												
			42,083	Postdocs 8		Postdocs												
			8,193	Research support staffs 10		Research support staffs	621	Research support staffs 4			3,101	Research support staffs 2						
			131,881	Administrative staffs 31	193	Administrative staffs 19	23,052	Administrative staffs 7										
Subtotal	544,970		513,072	95	5,124	24	23,673	11	-	0	3,101	2	-	0	-	0	-	0
Project activities	181,818	Operational subsidies to National University Corporations/Incorporated Administrative Agency	619	Honorarium for invited PIs, etc.	-	Honorarium for invited PIs, etc.	-	Honorarium for invited PIs, etc.										
	19,722	Funding by WPI Academy	-	Costs for maintaining satellites	3,798	Costs for maintaining satellites	4,842	Costs for maintaining satellites										
	15,004	Government Subsidies except Funding from WPI Academy	8,239	Costs for start-up	-	Costs for start-up	3,862	Costs for start-up										
	-	Donations	3,145	Costs for fusion research	-	Costs for fusion research	-	Costs for fusion research										
	43,476	Indirect funding	-	Costs for Target Projects	-	Costs for Target Projects	-	Costs for Target Projects										
	-	Joint research projects	10,507	Costs to hold international symposia	-	Costs to hold international symposia	1,882	Costs to hold international symposia										
	-	Competitive funding	63,446	Expenses for consumables	878	Expenses for consumables	-	Expenses for consumables			2,239	Expenses for consumables						
	-	Others	15,101	Light, heating and water utility costs	-	Light, heating and water utility costs	-	Light, heating and water utility costs			40,012	Light, heating and water utility costs						
			80,761	Others	15,046	Others	4,418	Others			1,225	Others						
Subtotal	260,020		181,818		19,722		15,004		-		43,476		-		-		-	
Travel	24,881	Operational subsidies to National University Corporations/Incorporated Administrative Agency	8,769	Domestic travel expenses	25	Domestic travel expenses	132	Domestic travel expenses			312	Domestic travel expenses						
	5,710	Funding by WPI Academy	11,937	Overseas travel expenses	4,400	Overseas travel expenses	2,369	Overseas travel expenses			698	Overseas travel expenses						
	6,301	Government Subsidies except Funding from WPI Academy	-	Travel expenses for GI3 Lab Program	807	Travel expenses for GI3 Lab Program	-	Travel expenses for GI3 Lab Program										
	-	Donations	4,175	Travel expenses for inviting guests	478	Travel expenses for inviting guests	3,800	Travel expenses for inviting guests										
	1,010	Indirect funding	-	Personal transfer allowance	-	Personal transfer allowance	-	Personal transfer allowance										
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	37,902		24,881		5,710		6,301		-		1,010		-		-		-	
Equipment	25,135	Operational subsidies to National University Corporations/Incorporated Administrative Agency	25,135	Costs for facilities/equipment	9,444		5,022				17,094							
	9,444	Funding by WPI Academy																
	5,022	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	17,094	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	56,695		25,135		9,444		5,022		-		17,094		-		-		-	
Research projects	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency							24,781				130,305		296,619	KAKENHI	26,667	Others
	-	Funding by WPI Academy													398,293	Consigned research funds (JST, others)		
	-	Government Subsidies except Funding from WPI Academy																
	24,781	Donations																
	-	Indirect funding																
	130,305	Joint research projects																
	694,912	Competitive funding																
	26,667	Others																
Subtotal	876,665		-		-		-		24,781		-		130,305		694,912		26,667	
Others	294,944	Operational subsidies to National University Corporations/Incorporated Administrative Agency	294,944	Depreciation costs														
	-	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	-	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	294,944		294,944		-		-		-		-		-		-		-	
Total	2,071,196		1,039,850		40,000		50,000		24,781		64,681		130,305		694,912		26,667	

Operational subsidies to National University Corporations/Incorporated Administrative Agency	運営費交付金
Funding by WPI Academy	WPIアカデミー国際頭脳循環の加速・拡大事業
Government Subsidies except Funding from WPI Academy	機関補助金（WPIアカデミー国際頭脳循環の加速・拡大事業を除く
Donations	寄付金
Indirect funding	間接経費
Joint research projects	共同研究費
Competitive funding	競争的資金
Others	その他

Project Expenditures FY2018

（Thousand yens）

	Amount	Details	Operational subsidies to National University Corporations/Incorporated Administrative Agency		Funding by WPI Academy		Government Subsidies except Funding from WPI Academy		Donations		Indirect funding		Joint research projects		Competitive funding		Others	
			Total costs	Details (no. of persons)	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details
Personnel	493,595	Operational subsidies to National University Corporations/Incorporated Administrative Agency	3,114	Center director 1														
	4,923	Funding by WPI Academy	10,595	Administrative director 1				Administrative director										
	35,886	Government Subsidies except Funding from WPI Academy	147,514	Principal investigators 18	2,633	Principal investigators 1	-	0	-	0	-	0	-	0	-	0	-	0
	-	Donations	61,406	・Full-time／Japanese 10	-	・Full-time／Japanese												
	3,458	Indirect funding	71,364	・Concurrent／Japanese 5	-	・Concurrent／Japanese												
	-	Joint research projects	6,365	・Full-time／Overseas 2	-	・Full-time／Overseas												
	-	Competitive funding	8,379	・Concurrent／Overseas 1	2,633	・Concurrent／Overseas 1												
	-	Others	176,170	Other researchers 22	-	Other researchers 0	-	0	-	0	-	0	-	0	-	0	-	0
			176,170	・Associate professor /Assistant professor 22	-	・Associate professor /Assistant professor												
			-	・Others	-	・Others												
			24,108	Postdocs 6	713	Postdocs 1												
			2,629	Research support staffs 12	-	Research support staffs 4	11,100	Research support staffs 4			3,458	Research support staffs 2						
			129,465	Administrative staffs 17	1,577	Administrative staffs 2	24,786	Administrative staffs 5										
Subtotal	537,862		493,595	77	4,923	4	35,886	9	-	0	3,458	2	-	0	-	0	-	0
Project activities	165,147	Operational subsidies to National University Corporations/Incorporated Administrative Agency	5,600	Honorarium for invited PIs, etc.	-	Honorarium for invited PIs, etc.	281	Honorarium for invited PIs, etc.										
	20,451	Funding by WPI Academy	-	Costs for maintaining satellites	3,599	Costs for maintaining satellites	-	Costs for maintaining satellites										
	7,641	Government Subsidies except Funding from WPI Academy	-	Costs for start-up	-	Costs for start-up	606	Costs for start-up										
	-	Donations	14,435	Costs for fusion research	-	Costs for fusion research	-	Costs for fusion research										
	52,277	Indirect funding	12,134	Costs for Target Projects	-	Costs for Target Projects	-	Costs for Target Projects										
	-	Joint research projects	6,383	Costs to hold international symposia	-	Costs to hold international symposia	1,649	Costs to hold international symposia										
	-	Competitive funding	31,331	Expenses for consumables	61	Expenses for consumables	2,037	Expenses for consumables			1,099	Expenses for consumables						
	-	Others	9,521	Light, heating and water utility costs	-	Light, heating and water utility costs	-	Light, heating and water utility costs			49,368	Light, heating and water utility costs						
			85,743	Others	16,791	Others	3,068	Others			1,810	Others						
Subtotal	245,516		165,147		20,451		7,641		-		52,277		-		-		-	
Travel	24,855	Operational subsidies to National University Corporations/Incorporated Administrative Agency	11,572	Domestic travel expenses	8	Domestic travel expenses	153	Domestic travel expenses			546	Domestic travel expenses						
	6,446	Funding by WPI Academy	10,282	Overseas travel expenses	5,574	Overseas travel expenses	-	Overseas travel expenses			5	Overseas travel expenses						
	1,473	Government Subsidies except Funding from WPI Academy	93	Travel expenses for GI3 Lab Program	864	Travel expenses for GI3 Lab Program	-	Travel expenses for GI3 Lab Program										
	-	Donations	1,576	Travel expenses for inviting guests	-	Travel expenses for inviting guests	1,320	Travel expenses for inviting guests										
	551	Indirect funding	1,332	Personal transfer allowance	-	Personal transfer allowance	-	Personal transfer allowance										
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	33,325		24,855		6,446		1,473		-		551		-		-		-	
Equipment	62,669	Operational subsidies to National University Corporations/Incorporated Administrative Agency	62,669	Costs for facilities/equipment							10,606							
	-	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	10,606	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	73,275		62,669		-		-		-		10,606		-		-		-	
Research projects	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency							16,519				32,883		254,742	KAKENHI	20,370	Others
	-	Funding by WPI Academy													494,817	Consigned research funds (JST, others)		
	-	Government Subsidies except Funding from WPI Academy																
	16,519	Donations																
	-	Indirect funding																
	32,883	Joint research projects																
	749,559	Competitive funding																
	20,370	Others																
Subtotal	819,331		-		-		-		16,519		-		32,883		749,559		20,370	
Others	200,009	Operational subsidies to National University Corporations/Incorporated Administrative Agency	200,009	Depreciation costs														
	-	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	-	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	200,009		200,009		-		-		-		-		-		-		-	
Total	1,909,318		946,275		31,820		45,000		16,519		66,892		32,883		749,559		20,370	

Operational subsidies to National University Corporations/Incorporated Administrative Agency	運営費交付金
Funding by WPI Academy	WPIアカデミー国際頭脳循環の加速・拡大事業
Government Subsidies except Funding from WPI Academy	機関補助金（WPIアカデミー国際頭脳循環の加速・拡大事業を除く
Donations	寄付金
Indirect funding	間接経費
Joint research projects	共同研究費
Competitive funding	競争的資金
Others	その他

Project Expenditures FY2019

（Thousand yens）

	Amount	Details	Operational subsidies to National University Corporations/Incorporated Administrative Agency		Funding by WPI Academy		Government Subsidies except Funding from WPI Academy		Donations		Indirect funding		Joint research projects		Competitive funding		Others	
			Total costs	Details (no. of persons)	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details	Total costs	Details
Personnel	498,182	Operational subsidies to National University Corporations/Incorporated Administrative Agency	9,415	Center director 1														
	7,235	Funding by WPI Academy	5,303	Administrative director 0			6,395	Administrative director 1										
	30,125	Government Subsidies except Funding from WPI Academy	138,392	Principal investigators 15	3,219	Principal investigators 1	-	0	-	0	-	0	-	0	-	0	-	0
	-	Donations	117,178	・Full-time／Japanese 10	-	・Full-time／Japanese												
	5,764	Indirect funding	17,008	・Concurrent／Japanese 4	-	・Concurrent／Japanese												
	-	Joint research projects	-	・Full-time／Overseas 0	-	・Full-time／Overseas												
	-	Competitive funding	4,206	・Concurrent／Overseas 1	3,219	・Concurrent／Overseas 1												
	-	Others	193,307	Other researchers 29	-	Other researchers 0	-	0	-	0	-	0	-	0	-	0	-	0
			193,307	・Associate professor /Assistant professor 29	-	・Associate professor /Assistant professor												
			-	・Others	-	・Others												
			17,444	Postdocs 3	1,063	Postdocs 1												
			18,607	Research support staffs 13	-	Research support staffs	12,336	Research support staffs 3			5,764	Research support staffs 2						
			115,714	Administrative staffs 19	2,953	Administrative staffs 1	11,394	Administrative staffs 2										
Subtotal	541,306		498,182	80	7,235	3	30,125	6	-	0	5,764	2	-	0	-	0	-	0
Project activities	191,697	Operational subsidies to National University Corporations/Incorporated Administrative Agency	5,500	Honorarium for invited PIs, etc.	-	Honorarium for invited PIs, etc.	265	Honorarium for invited PIs, etc.										
	20,207	Funding by WPI Academy	8,353	Costs for maintaining satellites	5,329	Costs for maintaining satellites	-	Costs for maintaining satellites										
	5,194	Government Subsidies except Funding from WPI Academy	-	Costs for start-up	-	Costs for start-up	2,000	Costs for start-up										
	-	Donations	20,862	Costs for fusion research	-	Costs for fusion research	-	Costs for fusion research										
	65,216	Indirect funding	18,242	Costs for Target Projects	-	Costs for Target Projects	-	Costs for Target Projects										
	-	Joint research projects	9,821	Costs to hold international symposia	-	Costs to hold international symposia	-	Costs to hold international symposia										
	-	Competitive funding	816	Costs to hold workshops/meetings	-	Costs to hold workshops/meetings	-	Costs to hold workshops/meetings			560	Expenses for consumables						
	-	Others	32,876	Expenses for consumables	19	Expenses for consumables	-	Expenses for consumables			59,418	Light, heating and water utility costs						
			-	Light, heating and water utility costs	-	Light, heating and water utility costs	-	Light, heating and water utility costs			5,238	Others						
			95,227	Others	14,859	Others	2,929	Others										
Subtotal	282,314		191,697		20,207		5,194		-		65,216		-		-		-	
Travel	21,011	Operational subsidies to National University Corporations/Incorporated Administrative Agency	10,084	Domestic travel expenses	774	Domestic travel expenses	106	Domestic travel expenses			35	Domestic travel expenses						
	4,818	Funding by WPI Academy	7,207	Overseas travel expenses	989	Overseas travel expenses	1,440	Overseas travel expenses			158	Overseas travel expenses						
	1,681	Government Subsidies except Funding from WPI Academy	-	Travel expenses for GI3 Lab Program	758	Travel expenses for GI3 Lab Program	-	Travel expenses for GI3 Lab Program										
	-	Donations	1,751	Travel expenses for inviting guests	2,297	Travel expenses for inviting guests	135	Travel expenses for inviting guests										
	193	Indirect funding	1,969	Personal transfer allowance	-	Personal transfer allowance	-	Personal transfer allowance										
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	27,703		21,011		4,818		1,681		-		193		-		-		-	
Equipment	15,581	Operational subsidies to National University Corporations/Incorporated Administrative Agency	15,581	Costs for facilities/equipment														
	-	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	-	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	15,581		15,581		-		-		-		-		-		-		-	
Research projects	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency							24,860				41,226		284,302	KAKENHI	5,893	Others
	-	Funding by WPI Academy													447,677	Consigned research funds (JST, others)		
	-	Government Subsidies except Funding from WPI Academy																
	24,860	Donations																
	-	Indirect funding																
	41,226	Joint research projects																
	731,979	Competitive funding																
	5,893	Others																
Subtotal	803,958		-		-		-		24,860		-		41,226		731,979		5,893	
Others	254,057	Operational subsidies to National University Corporations/Incorporated Administrative Agency	254,057	Depreciation costs														
	-	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	-	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	254,057		254,057		-		-		-		-		-		-		-	
Total	1,924,919		980,528		32,260		37,000		24,860		71,173		41,226		731,979		5,893	

Operational subsidies to National University Corporations/Incorporated Administrative Agency	運営費交付金
Funding by WPI Academy	WPIアカデミー国際頭脳循環の加速・拡大事業
Government Subsidies except Funding from WPI Academy	機関補助金（WPIアカデミー国際頭脳循環の加速・拡大事業を除く
Donations	寄付金
Indirect funding	間接経費
Joint research projects	共同研究費
Competitive funding	競争的資金
Others	その他

Appendix 4 Outreach Activities and Their Results

List up to three of the Center's outreach activities carried out during the period between FY 2017 and 2019 that have contributed to enhancing the brand or recognition of your Center and/or the brand of the overall WPI program, and describe its concrete contents and effect in narrative style. (Where possible, indicate the results in concrete numbers.)

Examples:
- As a result of using a new OO press-release method, a OO% increase in media coverage was obtained over the previous year.
- By holding seminars for the public that include people from industry, requests for joint research were received from companies.
- We changed our public relations media. As a resulting of using OO to disseminate information, a OO% increase in inquiries from researchers was obtained over the previous year.
- As a result of vigorously carrying out OO outreach activity, ¥OO in external funding was acquired.

Enter a list of your outreach activities in Attachment 4a.

From FY2017 to FY2019, PR & Outreach Office of AIMR made much effort to obtain the global recognition as a top-class research institute. The office managed AIMR website, published AIMR Magazine Vol. 9 and participated in promotion events. In addition, the office supported press-releases by researchers. As a result, significant research achievements by AIMR researchers were covered and reported in the various media. Special achievements obtained through three-year outreach activities are summarized below:

Example 1: Renewing outreach media

In October 2019, all the outreach media such as AIMR website, pamphlets, booklets and promotion video were renewed due to the change of institute director. To send our clear message with AIMR's ultimate goal of a "predictive new materials science," all the outreach media were made simpler and more straightforward. As a result of these renewals, about 10% increase in visiting of AIMR website was obtained in October, as compared to previous months.

Example 2: Cooperation with high schools and high school students

In 2017 AIMR had an official request from the director of Natural Science Division of Miyagi-soubun to become the place for students' study tour. By discussion with high school teachers in Miyagi prefecture, AIMR opened three laboratories and accepted visiting students. About 40 students experienced the cutting-edge science such as superconductive materials, fuel cell and bio-mimetics, leading to the best chance for them to take an interest in science.

Furthermore, "The 2018 Tohoku UK-Japan Young Scientists Workshop" was held in August 2018. AIMR accepted 10 high school students selected from Fukushima High School (SSH) and the Clifton Scientific Trust in the UK. They tackled 2 research topics.

Example 3: Encouraging researcher's press-release

PR & Outreach Office of AIMR strongly encouraged press-release especially for young researchers. Total number of releases in 2019 increased 160% as compared to that in 2018. As accord with press-release increasing and synergetic effect of renewing outreach media, contract number and income of collaboration with industries in 2019 increased to 147% and 167%, respectively.

Appendix 4a State of Outreach Activities from FY2017 to FY2019

* For each activity, enter the number of times that the activity was held each fiscal year.

Activities	FY2017 (number of activities, times held)	FY2018 (number of activities, times held)	FY2019 (number of activities, times held)
PR brochure, pamphlet	7	6	7
Lectures, seminars for general public	3	5	4
Teaching, experiments, training for elementary, secondary and high school students	1	1	0
Science café	1	2	0
Open house	1	0	1 (canceled by Typhoon)
Participating, exhibiting in events	2	3	2
Press releases	17	15	24
Publications of popular science books	0	0	1

*If there are activities that the center hasn't implemented, delete those lines. If you have other activities, list them in the space between parentheses after "Others" and state the number of times they were held in the spaces on the right. Another line under "Others" can be added, if needed.

<Notes>

From FY2017 to FY2019, PR & outreach office of AIMR made much effort to obtain the global recognition as a top class research institute. Special achievements obtained by executed outreach activities are summarized in the Appendix 4.

WPI Academy
List of Center's Research Results

Refereed Papers published from 2017 to 2019

Order of Listing

Category A: WPI papers
1. Original articles
2. Review articles
3. Proceedings
4. Other English articles
5. Articles written in other than English

Category 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) Abe, H; Matsue, T; Yabu, H, Reversible Shape Transformation of Ultrathin Polydopamine-Stabilized Droplet. Langmuir **33**, 6404-6409 (2017).
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A-4. Other English articles

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B. WPI-related papers

B-1. Original articles

N/A

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