World Premier International Research Center Initiative (WPI)
Activities Report of the WPI Academy Center
(FY 2020 – FY 2023)

Host Institution	Tohoku University	Host Institution Head	Teiji Tominaga
Research Center	Advanced Institute for Materials Research (AIMR)		
Center Director	Shin-ichi Orimo	Administrative Director	Maki Suemitsu

Common Instructions:
* Unless otherwise specified, prepare this report based on the current (31 March 2024) 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 Advanced Institute for Materials Research (AIMR) at Tohoku University was established in 2007 as one of the five centers selected for the MEXT's WPI. Since 2017, AIMR, as a WPI Academy member, has been conducting its unique collaborative research between mathematics and materials science (Math/MatSci). In fiscal year 2019, AIMR set three "Advanced Target Projects (ATP)" focusing on (1)Local-Global Connection (2)Dynamic System and Imaging, and (3)Reactivity and Response, which was recently shifted to more material-oriented categorization of (1)quantum/spin, (2)energy, and (3)bio/soft, respectively. As of March 2024, 55% of 186 researchers are foreign researchers and 20% are female researchers. The budget for FY2023 is 2.279 billion yen, and the amount received for joint research and other projects has roughly doubled in the past four years. AIMR aims to maintain its excellent research environment and to contribute to the betterment of society through revolutionizing Materials Science.

Advancing Research of the Highest Global Level

To reach its goal of contributing to the societal betterment through revolutionizing materials science, AIMR appointed Professor Shin-ichi Orimo as the new center director in 2019, who set three Advanced Target Projects (ATP) as the main direction of the AIMR research. In ATP1, quantum and spin materials are pursued to realize reservoir computing using spin waves, AI computing using probabilistic spin dynamics, and to explore new quantum properties of low-dimensional materials using math-based theories and advanced electronic spectroscopies. In ATP2, energy materials and devices, which include nanoporous carbon materials applied to a catalyst and next-generation green-transformation (GX) devices, are being developed. Math plays an important role in this field as well, as, for example, the number theory greatly simplifies the analysis of grain boundary structures in crystals. In ATP3 on bio-soft materials, hierarchical neuronal networks are successfully constructed, a continuous synthesis method for metal oxide nanoparticles is developed, and their dispersion and aggregation properties are mathematically clarified. In 2023, 374 academic papers were published in AIMR and the proportion of the top 10% papers was ~15%, the FWCI ~1.5, and the proportion of internationally co-authored papers reached as high as 68%.

Facilitating Interdisciplinary Research Activities

The presence of mathematicians plays a vital role in connecting individual research in AIMR. In the Fusion Research (FR) Program to promote interdisciplinary research among young researchers, applicants are asked to include mathematicians in their team. Math also helps AIMR outreach its MatSci research to off-campus institutions, especially via Open Innovation Centers (OIC). The AIMR Center of Mathematical Sciences for Open Innovation, responds to industrial needs through topological data analysis (TDA) technology developed in AIMR, attracting many companies. Lively discussions are being made within the Keidanren (Japan Business Federation) Industry-Academia Collaboration Initiative for the Utilization of Mathematics. The Fujitsu × Tohoku University Discovery Intelligence Laboratory, run mainly by AIMR researchers, is dedicated to solve fundamental societal issues such as to explain AI decisions. The math-based interdisciplinary research contributes to human resource development as well. G-RIPS Sendai, the international internship program welcomed 23 international students in 2023, who worked together to solve problems provided by 4 domestic companies. Part of these inter-institutional collaborations was

carried out using the cross-appointment system, such with Kyushu University and AIST (The National Institute of Advanced Industrial Science and Technology). Finally, AIMR's interdisciplinary research aims to realize a green future society. AIMR runs the Hydrogen Science Open Innovation Center for GX, which became the basis for the selection of a JST-GteX research project in 2023. AZUL, a new rare-metal-free catalyst, attracts industrial attention for the next-generation energy device implemented in society.

Maintaining an International Research Environment

Even after the end of the WPI funding period, AIMR, thanks to the support from Tohoku University, has been able to promote strategic personnel management. With 28 outstanding leading principal investigators (PIs) from the world, AIMR maintains a world-leading international research group in materials science. The open call for young independent faculty members at the Core Research Cluster for Materials Science (CRC-MS), led mainly by AIMR, found 85 applicants for 2 positions (2023). Additionally, AIMR has signed contracts with 20 overseas researchers between 2020 and 2022. To help these overseas researchers get started in their research in AIMR, the International Affairs Section (IAC), the Computational Support Unit, and the Common Equipment Room play important roles. On-budget pre-award support for young and foreign researchers is also available in the Research Support Division (RSD). The proportion of foreign researchers increased from 36% in 2019 to 54% in 2023. To support short-term international exchange, we offer the GI^3 Lab Program, which invites top researchers from overseas. Overseas dispatch program for young researchers is also available. To help these diverse overseas researchers from a wide range of fields get used to life in Japan and promote interdisciplinary collaboration, the AIMR organically organizes seminars and teatimes to provide a forum for free interaction and the budding of interdisciplinary research.

Making Organizational Reforms

After the WPI support period ended, Tohoku University (TU) positioned AIMR as a regular department, but with an allowance of its director-wide discretion. AIMR's administrative department functions as a research support division (RSD) to ensure that researchers have the maximum amount of time to conduct their research. The director of RSD is responsible for the creation of an environment in which researchers can concentrate on their research. In 2023, AIMR hired an international collaboration coordinator to strongly promote academic exchange with world-class universities. The Strategic Public Relations Office welcomed a sub-manager with a doctorate to strengthen the dissemination of the AIMR's research results in 2024. When the university-wide International Support Center (ISC) was launched in 2022, IAC fully lent its know-how. IAC still preserves its importance in AIMR, however, where foreign researchers form the majority (55%). Needless to say, AIMR greatly helped the university headquarters and JAMSTEC propose a new WPI center (AIMEC) at TU, which ended in success.

Efforts expected to WPI Academy Center to Enhance and Amplify the Visibility and Brand of the Overall WPI Program

The AIMR's brand image, as well as that of WPI Academy, can be recognized by the numerous visitors from Japan and abroad to the institute. To preserve and enhance these brand images, AIMR has been organizing a series of international symposia in a regular basis. The Strategic Public Relations Office (SPRO) widely disseminates AIMR's findings through newspapers, websites, television, and other means. SPRO is currently pushing English-language press releases, whose number tripled from FY2022 to FY2023 (9 to 27). AIMR's public relations magazine "AIMResearch," now became an online content, serves to enhance the visibility of AIMR.

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

As a regular university department, AIMR is being provided with resources and infrastructure from the university at a regular basis. In the TU's "3rd Mid-Term Goals and Plans (FY2016-2021)" in response to the requirement by MEXT, the Core Research Clusters (CRC), to which AIMR belongs, received the highest rating of "S." In the "4th Mid-Term Goals and Plans" starting in FY2022, CRC has been placed in the first layer in its "Three-layered Research Enhancement Package." As of June 2024, Tohoku University remains the only candidate for certification under the University for International Research Excellence, for which AIMR's achievements in materials science may have contributed. The importance of AIMR, as a pilot institute for international collaboration, will surely increase if certified.

Others

The NanoTerasu, a high-brightness synchrotron radiation facility, began operation at Tohoku University's new Aobayama campus in April 2024. AIMR has been and will be leading the cutting-edge measurements, only possible at NanoTerasu.

* 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 Advanced Institute for Materials Research (AIMR) at Tohoku University, established in 2007 as one of the WPI centers, has been pursuing the WPI's mission of (1) top-level science, (2) cross-disciplinary research, (3) system reform, and (4) internationalization to create a "globally visible research center" in Japan that boosts an excellent research environment and extremely high research standards that will attract many leading researchers from around the world in the field of materials science. AIMR was supported by the WPI program until FY2016 and recognized as an innovative institute promoting mathematics and materials science (Math/MatSci) collaboration at the institute level.

After completion of the WPI project, AIMR was accredited as a "WPI Academy Center" in FY2017 and continues to maintain its status as one of the 18 WPI centers in Japan. To accelerate the Math/MatSci collaboration, the AIMR's identity established during the WPI Center era, and to lead its results to the creation of revolutionary materials in the long term, AIMR set three "Advanced Target Projects (ATP)" focusing on (ATP1) Local-Global Connection, (ATP2) Dynamic System and Imaging, and (ATP3) Reactivity and Response in FY2019. This categorization was recently shifted to a more material-oriented one: (ATP1) quantum/spin, (ATP2) energy, and (ATP3) bio/soft. All researchers at AIMR are working together in this direction through various interdisciplinary collaborations. As of March 2024, 55% of 186 researchers are foreign researchers and 20% are female researchers. The budget for FY2023 is 2.279 billion yen, and the amount received for joint research and other projects has roughly doubled in the past four years. AIMR aims to maintain its excellent research environment and to contribute to the betterment of society through revolutionizing Materials Science.

As of March 31, 2024, 28 PIs and 5 junior PIs listed in **Appendix 2** are leading the laboratories, with its management structure being illustrated in **Appendix 3-1**. The center consists of 259 members, including 186 researchers and 28 administrative and staff members. Of the 186 researchers, 101 are non-Japanese researchers (54%) including the 12 non-Japanese PIs. The number of female researchers is currently 41, and their ratio to the total number of researchers is 22%, which is gradually increasing (17% in FY2021 and 19% in FY2022). Please also refer to **Appendix 3-1a** and **Appendix 3-1b** with respect to the numbers of researchers and staff members affiliated with AIMR and the positions postdoctoral researchers got after leaving AIMR, respectively.

The budget for FY2023 was 2.279 billion yen, of which 1.046 billion yen was from the host institution, 1.202 billion yen was from competitive funds, and 0.03 billion yen was from WPI Academy. Financial support from the host institution has remained steady, despite the efficiency factor of 1.6%/year, partly due to an increase in indirect costs of competitive funds. The amount of joint and funded research, etc. nearly doubled from 0.490 billion yen to 0.960 billion yen over the four years from FY2019 to FY2023 (**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 2020-2023 in a manner prescribed in Appendix A.

The goal of AIMR is to discover new scientific principles, utilize them to develop new functional materials and devices, and thereby contribute to the societal betterment. As for the discovery of new scientific principles, the fusion between mathematics and materials science (Math/MatSci), a highly evaluated identity of AIMR at the end of the WPI-support term, has been proved quite successful. To apply this Math/MatSci fusion research to the development of new materials, AIMR appointed Professor Shin-ichi Orimo (PI at AIMR on January 1, 2013, and Deputy Director on November 1, 2018) as the new Center Director on October 1, 2019. AIMR, under the leadership of Prof. Orimo, is now conducting research under the following three Advanced target projects (ATPs).

[ATP1] Quantum and Spin materials: Proof-of-concept of fast and energy-saving reservoir computing using spin waves, demonstration of AI calculator using stochastic spin dynamics, development of new quantum properties such as topological properties of aligned atoms by lights, and advanced electron spectroscopy (micro-ARPES) to analyze ultra-fine powder samples.
[ATP2] Energy materials: Catalytic application of nano-porous carbon materials and its characterization of their structure by discrete geometry analysis, analysis of grain boundary structures by number theory, analysis of ion dynamics by persistent homology, generation of database for material designing of solid electrolytes, next generation GX device and catalysts without using rare or heavy metals.
[ATP3] Bio-Soft materials: Construction of hierarchical neuronal networks and demonstration of reservoir computing, development of new functional materials using mathematically predicted structures of polymers, supramolecules, and molecular crystals, development of nanoparticle synthesis by continuous flow hydrothermal method for metal oxide nanoparticles and mathematical understanding of their dispersion-aggregation properties.

Our remarkable 20 papers showing the results obtained through ATPs and some other important achievements are summarized in **Appendix 1** (item 1). Please refer to **Attachment A** with regard to all of the papers published in 2020-23.

The percentage of the Top 10% papers, a KPI, was ~15% at the end of FY2023, and the Field-weighted Citation Impact (FWCI) was ~1.5. In 2023, we published a total of 374 academic papers, including 35 papers in high-impact factor journals such as Nature, Science, and Phys.Rev.Lett. The proportion of internationally co-authored papers was 68%. These achievements were backed by a junior PI who joined AIMR through an international call and by overseas PIs invited in FY2021-2022. It can be said that AIMR's efforts to improve the research environment by inviting top overseas researchers have been successful. Many of these researchers have been awarded awards such as Humboldt Research Award and Japan Academy Prize as shown in **Appendix 1** (item 3).

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.

AIMR facilitates fusion (interdisciplinary) research under three Advanced Target Projects (ATPs) consisting of quantum and spin materials (ATP1), energetic materials (ATP2), and bio- and soft materials (ATP3). Mathematicians in AIMR, despite their independence, are closely related to these ATPs, making their presence a strong driving force for fusion research at AIMR.

One of the mechanisms to promote fusion research in AIMR from a budgetary perspective is the Fusion Research (FR) Program, which, as its name suggests, aims to promote interdisciplinary fusion research among researchers at AIMR. The FR program is currently operated as a research start-up support for young researchers (11 projects adopted in FY2020, 5 in FY2021, 6 in FY2022, and 11 in FY2023).

Math-mediated fusion research with extramural partners is promoted at several Open Innovation Centers (OICs) in AIMR. The Mathematical Sciences OIC promotes various collaborations centered on math-based materials science, which includes the TDA (Topological Data Analysis) technology that has been increasingly needed in industry as it provides a mathematical framework that links microstructures and macroscopic properties. The number of participating companies and members in the TDA community, which were 15 companies and 28 members at the time of its establishment in FY2020, increased to 56 companies and 100 members in FY2023. The TDA community is also expanding horizontally within the university including guidance to master's course students in the Faculty of Engineering. With RIKEN, AIMR attracted SUURI-COOL (Sendai) in FY2018, a collaboration center of the RIKEN's Interdisciplinary Theoretical and Mathematical Sciences Program (iTHEMS).

To attract such OICs from extramural research institutions, the cross-appointment (CA) system has been quite effective. With the National Institute of Advanced Industrial Science and Technology (AIST), four researchers (professor and associate professor) are currently working at AIST-TohokuU Mathematics for Advanced Materials Open Innovation Laboratory (MathAM-OIL). The CA system serves to the retention of an AIMR researcher in employment.

For mathematics-mediated fusion research with industry, AIMR is promoting it in close collaboration with

the Mathematical Science Center for Co-creative Society of the host institution. The "Fujitsu×Tohoku University Discovery and Intelligence Laboratory" aims to conduct research and development of "discovery mathematics" that uses data and AI to discover solutions to problems in various fields. AIMR researchers are involved on four topics running in the laboratory. In particular, causal inference, one of important methodologies in mathematics, is becoming increasingly important also as a new approach to explaining AI decisions. The Keidanren (Japan Business Federation) Initiative for Industry-Academia Collaboration in Mathematical Applications, aims to promote collaboration between industry and the mathematical community. It regularly gathers 40-60 participants from industry to evoke lively discussions and networking on mathematical approaches to industrial issues such as data utilization, AI, and smart designing.

Math-mediated fusion research also provides an excellent venue for human resource development: the international internship G-RIPS Sendai program, launched at AIMR in FY 2018, is currently being managed in collaboration with other organizations on campus, including Tohoku Forum for Creativity and the Mathematical Science Center for Co-creative Society. The program is based on close international collaboration with IPAM (Institute for Pure & Applied Mathematics) at UCLA, U.S.A., and provides an eight-week program for mixed teams of Japanese and American (and recently African) graduate students in mathematics working on mathematical problems provided by partner companies. The program, initially started with two companies and eight students now invites 21 students working on five problems provided by four companies. The program has achieved a variety of outcomes, such as a U.S. participant finding employment at a Japanese partner company and a project proposal resulting in a joint research agreement between a partner company and Tohoku University.

Fusion research at AIMR also expands to the realization of green society, an urgent issue for mankind, through material exploration and device implementation. To tackle this problem from the viewpoint of "hydrogen-related basic science", AIMR has established the "Open Innovation Center for Hydrogen Science for Green Transformation." These efforts have led AIMR to the selection of JST-GteX (Project for Creation of Innovative GX Technology) in 2023, in which hydrogen storage materials are investigated in depth, from clarification of the basic mechanism of hydrogen storage to innovation of materials, with the director serving as team leader uniting domestic research institutes.

Another energy-related, green research in AIMR is the development of "AZUL," a catalyst that does not use environmentally hazardous rare metals. AZUL is a new material made from metal complex blue pigment and inexpensive carbon materials and exceeds rare-metal catalysts in performance and cost. It is now bearing fruit in the form of social implementation results, such as high-performance metal-air batteries that are expected to become next-generation energy devices and paper batteries that can drive wearable devices, smart life jackets, and other devices.

AIMR, where a wide variety of researchers from materials scientists to mathematicians and from basic to applied fields reside "under one roof," makes effective use of seminars and teatimes (once a week) to stimulate fusion research. Teatime especially serves as a "place for research exchange" that could not have been created simply by researchers' participation in seminars, and its open and relaxed atmosphere certainly contributes to the formation of an international research environment at AIMR.

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.

The WPI program requires each center to run overseas satellites at its international partner institutions. AIMR has been operating three Joint Research Centers (JRC) at the University of Cambridge (UK), the University of Chicago (USA), and Tsinghua University (China) based on interdepartmental agreements (**Appendix 3-1**). At each JRC, AIMR hires one local post-doctoral researcher (Reference 2-1), thereby

promoting substantial international collaborative research. The University of Cambridge JRC is engaged in exploring new material structures and predicting functions using topological data analysis (TDA) and other mathematical methods, the University of Chicago JRC is in the development of quantum materials based on spintronics, and the Tsinghua University JRC is in the collaboration utilizing the AIMR's state-of-the-art angle-resolved photoemission spectroscopy (ARPES) measurement techniques. At the AIMR Workshop held in November 2023 (86 participants), the three post-doctoral fellows came to Sendai to have face-to-face exchanges with AIMR researchers and to have in-depth discussions on future fusion research.

AIMR, even after the WPI funding period ends, continues to bring together 28 outstanding principal investigators (PIs) and 5 Jr-PIs, including 11 researchers affiliated with overseas institutions. All of the PIs excluding 5 Jr-PIs are listed in **Appendix 2**. This international research environment was the fruit of the AIMR's effort to attract world-leading researchers as overseas PIs from FY2020 onward through the strategic appointment of the Center's Director. Specifically, AIMR welcomed Prof. M. Titirici of ICL in the UK in 2021, Prof. R. Mohtadi of TRINA in the US, Dr. R. Oda of CNRS in France, Dr. M. Hirscher of Max Planck in Germany, and Prof. H. Kim of POSTECH in Korea as new overseas PIs in 2022. The international open recruitment process for 2021 allowed AIMR to welcome the up-and-coming Prof. H. Li from DTU, Denmark. In FY2023, AIMR also recruited 2 young independent faculty members at Core Research Cluster for Materials Science at Tohoku University (CRC-MS), out of 85 (including 72 non-Japanese) applicants. Currently, AIMR accepts 4 PIs as CRC-MS members. In addition to the overseas PIs, AIMR has also promoted international joint research by concluding a total of 20 contract research agreements with overseas researchers from FY2020 to FY2022. Furthermore, in FY2023, AIMR concluded a contract with Prof. Jens K. Nørskov (Technical University of Denmark) and Prof. Astrid Pundt (Karlsruhe Institute of Technology), respectively, utilizing the CRC-MS overseas contracting system. The director Orimo visited Karlsruhe Institute of Technology to prepare for further collaboration in the future.

To help these overseas researchers quickly start their research life in Japan, AIMR provides various supports. The International Affairs Section (IAC) is a support section for procedures and living arrangements. For research start-ups, the Computation Support Unit provides shared core infrastructure, operational know-how, and customized available computing resources. The Common Equipment Room, equipped with pictogram displays and English-speaking staff, provides a quick and friendly atmosphere for the basics of sample preparation and analyses. The percentage of foreign researchers has increased from 36% in FY 2019 to 54% in FY 2023.

To support young researchers, AIMR provides a support package that includes: (1) subsidies for research maintenance and other expenses to meet urgent requests, (2) waivers of equipment usage fees at the Common Equipment Room (for research adopted by the Fusion Research Program), and (3) subsidies for English editing fees when submitting papers and preparing slides for presentations. In addition, AIMR continues to support young or non-Japanese researchers in brushing up their applications to obtain external funds such as Grants-in-Aid for Scientific Research, etc. To reduce the burden of annual faculty evaluation work, AIMR established a system that enables the extraction of desired data from the university information database (RefDBx).

The Global Intellectual Incubation and Integration Laboratory (GI^3 Lab) program is a system to induce a further international brain circulation triggered by overseas researchers accepted by AIMR. The program invites outstanding overseas researchers to stay at AIMR for a few weeks to a few months to promote exchanges with young researchers at AIMR. In addition, the Young Researcher Overseas Visits Program supports short-term stays at leading overseas laboratories and the presentation of research results at international conferences.

The Strategic Public Relations Office plays a vital role in raising the international visibility of AIMR. The office carefully selects papers less than three years old and located at the border of the top 10% category and publishes them on the AIMR website as AIMResearch. In addition, AIMR strongly encourages researchers to issue press releases in English, and the number of English press releases tripled from 9 in FY2022 to 27 in FY2023.

As COVID-19 converges, international brain circulation with overseas research institutions and academic circles has been reactivated through international symposia and joint workshops. In addition to the annual International Symposium of CRC-MS, we had an AIMR/South China University of Science and Technology Joint Workshop in FY2021, an AIMR/Tsinghua University/South China University of Science and Technology

Joint Workshop, and a Tohoku University/University of Bordeaux/University of Geneva Joint In FY2023. AIMR also hosted the AIMR/Imperial College London Joint Workshop.

5. Making Organizational Reforms

- 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.

The Administrative Division at AIMR is organized as the Research Support Division (RSD) under the leadership of the Center Director to ensure maximum research time for researchers. The WPI center is required to appoint an RSD Director in addition to the Center Director. The role of the RSD Director is to create an environment in which researchers can concentrate on their research and to promote the system reform from the perspective of researchers.

The RSD Director Prof. Nishiyama retired at the end of FY2023, having fulfilled his major responsibilities of the smooth implementation of strategic personnel changes in conjunction with the change of Director and the care of researchers during the outbreak of COVID-19. AIMR was able to recruit a researcher with excellent research achievements and skills in administrative organization management as the new RSD director.

The host institution, Tohoku University, has continued to regard AIMR as a regular department of the university after the end of the WPI support period and provides it with authority, resources, and infrastructure. While the university supports AIMR with a variety of resources, it respects AIMR's top-down management system, with the director at the top, and leaves almost all the important operational policies, such as personnel and budget for PIs and other center staff, to the discretion of the director, who makes decisions and implements them with flexibility.

This flexibility was leveraged to accelerate international collaborations and enhance AIMR's visibility abroad by strengthening the RSD staff. In 2023, a new coordinator for international collaboration was hired to accelerate overseas collaboration after the deregulation of COVID-19. Additionally, a new sub-manager was hired in the Strategic Public Relations Office to enhance the system for disseminating research results and increasing paper citations on behalf of researchers.

After joining WPI Academy in FY2017, AIMR considered the continuation of the regular meeting of AIMR International Advisory Board, which had been held every year until FY2016. We discussed this matter with some former members of AIMR International Advisory Board and External Advisory Board (consisting of domestic experts) and finally reorganized "AIMR Advisory Board" comprising some of the former members of International/External Advisory Boards and some new members we asked to join the board taking this opportunity. The meeting of the new AIMR Advisory Board was held online (due to the COVID-19 pandemic) in June 2021 and the report summarized by the board members was given to AIMR in April 2022. The board meeting is planned to be held every three or four years.

AIMR's expertise as a WPI member has been horizontally deployed within the host institution. The International Affairs Center (IAC) was established to provide a wide range of support for foreign researchers and their accompanying family members visiting Japan, from daily life to research activities. When part of this function of IAC at AIMR was consolidated into the university-wide International Support Center (ISC) in 2022, IAC played a major role in its launch. IAC is continuing or even expanding its support for foreign researchers by having more neat collaborations with other divisions such as Common Equipment Room to help newcomers smoothly start their research. Finally, for the foundation of AIMEC in 2023, the second WPI institute at Tohoku University, AIMR provided its full know-how concerning cooperation with foreign researchers, applications for research funding, and the new WPI center. This sharing continues after the foundation of AIMEC.

6. Efforts expected to WPI Academy Center 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.
- Describe the Center's efforts in making it a place that expands and accelerates the international circulation of the world's best brains. Give their success cases and describe their concrete contents and effect in narrative.
- Describe 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.

AIMR's outreach activities are handled by the Strategic Public Relations Office (SPRO), which publicizes AIMR's research results through newspapers, websites, television, and other media to disseminate the center's activities and raise awareness of the WPI program (**Appendix 4** and **Appendix 4a**). In FY2023, an online press conference was featured in 3 print newspaper articles (Nihon Keizai Shimbun, etc.) and 16 web-based articles (including Yahoo News). The press conference is another target SPRO pushes forward. SPRO recently works to increase the number of English press releases, which have by far the largest readership, by strongly encouraging applicants for Japanese press releases to issue English press releases as well. As a result, the number of English press releases tripled from 9 in FY 2022 to 27 in FY 2023. SRPO has been working on in-house production of "Research Highlights," an important content that introduces notable papers in the research publication "AIMResearch" (booklet and web). In 2021, we welcomed an AIMR alumnus as a new science writer. During the editing process, we revisited the significance and future prospects of the research, incorporating perspectives from non-experts. As a result of the renewal, the proportion of mathematics-related articles increased from 10% to 30%, leading to the strengthening of the AIMR brand of Math/MatSci collaboration. Additionally, by discontinuing the booklet version and focusing on web content, we increased the number of articles published each month by 1.5 times. Even after the renewal, we have maintained high page views and contributed to enhancing researchers' motivation to write papers and issue press releases.

The AIMR's brand image can be expressed as "a WPI center for Math/MatSci collaboration." This has been communicated domestically and internationally through the official website, SNS, and the AIMR introduction pamphlet (booklet and PDF file). Since FY2021, AIMR participated in the Research University Consortium Symposium as a WPI academy center and worked to improve the visibility and brand of the WPI. As for outreach activities of the WPI as a whole, AIMR participated every year in the WPI science symposium aimed at the general public and junior/senior high school students. To accelerate this series of outreach activities, SPRO hired a sub-manager in FY2023, a researcher with a Ph.D.

Finally, organizing symposia and international workshops is by far an essential means of enhancing the WPI/AIMR brand power through the original activities of AIMR. Since the inauguration of the Core Research Cluster for Materials Science (CRC-MS) at Tohoku University in FY2017, AIMR has held a joint international symposium with CRC-MS and the Center for Science and Innovation in Spintronics (CSIS) every year. The aforementioned math-mediated fusion research outside the university through the Open Innovation Centers (OIC) has greatly contributed to AIMR's branding.

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.

In 2017, the host institution, Tohoku University (TU), decided to position AIMR as a regular department of the university. With this understanding, TU continues to provide it with authority, resources, and infrastructure but with the condition that its support is renewed regularly. In the final evaluation of the achievements in the "Third Mid-Term Goals and Plans (FY2016-FY2021)," TU received the highest rating of "S" for the achievement of its "Research" goal. Since the Core Research Cluster (CRC), to which AIMR belongs, played a major role in this evaluation, CRC was positioned in the top layer in the university's "Three-Layered Research Enhancement Package" in the "Fourth Mid-term Goals and Plans" starting from FY2022,with further expansion being addressed.

Tohoku University remains the only candidate for the University for International Research Excellence (UIRE) provided by MEXT. AIMR may have made a nonnegligible contribution to this nomination through its cutting-edge achievements in materials science. Since UIRE aims to develop internationally outstanding

research, expectations on AIMR from TU should remain high to strengthen the university's research capabilities. The experience and know-how accumulated by AIMR as a WPI center and WPI-Academy center are expected to spread throughout the university and continue to grow sustainably in the future.

System reforms in the host institution evoked by AIMR form a good basis for continued support from TU in the future. The Organization for Advanced Studies (OAS) established in 2014 is a specialized department for research consisting of WPI-type centers throughout the university, which was aimed to spread the know-how of internationalization and system reform that AIMR has cultivated as a WPI center. Under OAS, Tohoku University has placed core research clusters (CRC) in four research fields, including CRC-MS dedicated to materials science. The International Support Center (ISC) was established by promoting the International Affairs Center (IAC) activities at AIMR to cover the needs throughout the University. IAC now supports foreign researchers at international open laboratories such as ELyTMaX (Lyon-Tohoku University Joint Laboratory supported by CNRS, France) and Tohoku Forum for Creativity (TFC). Finally, the establishment of the TU's second WPI, the Advanced Institute for Marine Ecosystem of Change (WPI-AIMEC), owes a lot to AIMR for its outstanding achievements as a WPI member and its support for the application.

The host institution, Tohoku University (TU), has provided financial support of about 0.8 billion yen per year for basic expenses to support the operation of AIMR even after it became a WPI-Academy member. In addition, 10 tenure posts are granted to AIMR as part of this support and are being utilized to employ outstanding PIs throughout the world. Part of this support came from the MEXT's National University Management Reform Promotion Project (FY2018-FY2021). Since TU received the highest rating of "S" for the final evaluation of this program, TU maintained its support for AIMR through the President's Discretionary Fund even after the program ended.

The AIMR Strategic Public Relations Office established good relationships with high schools designated as Super Science High Schools (SSH) until FY 2019, providing regular scientific advice and opportunities for high school students to interact with overseas researchers and students in English. About 80 students in the science and mathematics course at Miyagi Daiichi High School (2020 and 2021), 10 students in the science and mathematics course at Kitami Hokuto High School (2022), 42 students in the science and mathematics course at Tsuruoka Minami High School (2023), and 25 students from SSH schools in the Tohoku region (2023) visited AIMR. AIMR gave them an overview of the Institute and laboratory tours to motivate them to decide their future paths. In 2023, 25 high school students, selected from the Clifton Science Trust in the UK, visited the institute for the Japan-England Science Workshop and enjoyed three days of hands-on research activities and opportunities to summarize their research results.

8. Others

・In addition to the above1-7, note any of the Center's notable efforts and activities.

AIMR is promoting industry-academia collaboration aiming at connecting Materials Science as a top science to solutions to societal issues. The following exemplifies the fruits of the collaboration made in FY2023.

(1) Graphene mesosponge (GMS), a nanoporous carbon material, was characterized by discrete geometric analysis and was successfully applied to development of a low-cost, green catalysis.
(2) Artificial intelligence (AI) was successfully applied to generate a database that contributes to the material design of solid electrolytes and exploring new materials.
(3) Mathematical analysis on the phase separation of polymers was utilized to design a highly sensitive reagent for influenza virus detection using an antibody loaded on a designed polymer phase-separated structure.
(4) A mathematical description of the dispersion and aggregation properties of metal oxide nanoparticles was successfully obtained, which was utilized for the development of new materials.

As for big-project-based industry-academia co-creation, AIMR has won the JST-GteX (Green Technologies of Excellence) program in the hydrogen area in 2023. This project aims to develop and construct innovative hydrogen storage materials and systems by fully utilizing mathematical science such as DX, materials informatics, and topological data analysis.

Finally, AIMR is contributing to the NanoTerasu, the next-generation synchrotron radiation facility located in the Aobayama campus, Tohoku University. In 2023, AIMR hosted two symposia aimed at forming a research network in the field of nanometrology, an advanced metrology, each with more than 40

participants. New scientific directions that can be developed at NanoTerasu were discussed, and a framework for a domestic network was formed. A PI at AIMR has also been involved in beamline proposals and specifications, and has contributed to the development of advanced measurement research and development using the NanoTerasu by installing advanced nano-measurement equipment under their jurisdiction in the beamlines.

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 2020 and FY 2023, 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) (or DOI number), 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, since its establishment, has focused on fundamental understanding of materials at the atomic and molecular level and developed new materials and devices/systems based on such understanding. Therefore, the following 20 papers are arranged according to the order from fundamental understanding to development of new materials and devices/systems. In 2011, AIMR started mathematics-materials science collaboration and Target Project (TPs) to materialize the concept of mathematics-materials science collaboration. In 2019, AIMR renewed the TPs and started Advanced target Projects (**ATPs**) as described in the main text of this Activities Report. Since ATP1, ATP2, and ATP3 basically deal with quantum (spin-related) phenomena, molecular/meso-scale dynamics, and macroscopic level of materials and devices/systems, respectively, and the order of the 20 papers also corresponds to the order of **ATP1**, **ATP2**, and **ATP3**, roughly. The following list includes the results based on the cooperation between ATPs as well as other related research such as international collaboration and development of new mathematical tools.

1. Andreas Dechant, Tatsuhiko Ohto, Yoshikazu Ito, Marina V. Makarova, Yusuke Kawabe, Tatsufumi Agari, Hikaru Kumai, Yasufumi Takahashi, Hisashi Naito, Motoko Kotani, Geometric model of 3D curved graphene with chemical dopants. *Carbon*, **182**, 223-232 (2021). DOI: 10.1016/j.carbon.2021.06.004

   [A mathematical model to link geometry and properties (ATP1+ATP2)] The introduction of topological defects by chemical treatments of graphene alters geometry of graphene and consequently enhances catalytic properties though the detailed mechanism remains unclear. AIMR researchers and their collaborators developed a mathematical model called standard realization with repulsive interaction (SRRI) that uses the geometric information of graphene to simulate its defect-induced curvatures and properties. Experimental comparisons with the simulated properties suggested the possible use of SRRI as the pre-screening tool for both density functional theory (DFT) calculations and experimental measurements. The results show a mathematical modeling method that not only can pre-screen model systems for in-depth DFT studies but also can be used to guide experimental measurements in real time.

2. Satoshi Iihama, Yuya Koike, Shigemi Mizukami, and Natsuhiko Yoshinaga, Universal scaling between wave speed and size enables nanoscale high-performance reservoir computing based on propagating spin-waves. *npj Spintronics*, **2**, 5 (March 2024). DOI: 10.1038/s44306-024-00008-5

   ["RC" meets spin-waves (ATP1+ATP3)] AIMR considers that reservoir computing (**RC**) is an promising concept/tool which bridges the gaps between ATP1, ATP2, and ATP3. This time, RC was applied to spintronics (a theme of ATP1) though **RC** originally has a concept related to neural network (a theme of ATP3). Under the current circumstances, performance of spintronics **RC** is poor due to the lack of understanding of its mechanism. In this study, AIMR researchers demonstrated that the nanoscale physical **RC** using propagating spin waves could achieve high computational power. They developed the theory with response functions to understand the mechanism of high performance, and found that wave-based **RC** generated Volterra series of the input through delayed and nonlinear responses. The delay originated from wave propagation, and the scaling of system sizes played a crucial role in achieving high performance.

3. Viet Q.H. Huynh and Hiroshi Suito, Communication-hiding pipelined BiCGSafe methods for solving large linear systems. *Applied Mathematics and Computation*, **449**, 127868 (2023). DOI: 10.1016/j.amc.2023.127868

   [Iterative method with low communication cost in HPC (Mathematical tool)] Many

scientific and engineering applications lead to problems of solving linear equation systems. These equation systems often require high-performance computing (HPC) systems to obtain accurate solutions within a reasonable time frame. However, the increase of computing power of HPCs (the increase of the number of processors) is also accompanied by negative effect such as time-lags related to communication and synchronization. AIMR researchers addressed this issue by proposing a new method based on two recent approaches: the pipelined BiCGStab (p-BiCGStab) and the single-synchronized BiCGSafe (ssBiCGSafe). The proposed method inherits advantageous characteristics from each approach, namely, hiding communication latency and utilizing only one global reduction phase per iteration, respectively.

4. Satoru Tokuda, Seigo Souma, Kouji Segawa, Takashi Takahashi, Yoichi Ando, Takeshi Nakanishi, and Takafumi Sato, Unveiling quasiparticle dynamics of topological insulators through Bayesian modelling. ***Communications Physics***, **4**, 170 (2021). DOI: 10.1038/s42005-021-00673-6

   [Bayesian statistics for ARPES data analysis (ATP1)] In condensed-matter physics, the many-body problem often complicates experimental measurements. For example, the surface electronic states mapped by angle-resolved photoemission spectroscopy (ARPES) are a convolution of the bare-band dispersions with the electron self-energies. This convolution makes the discrimination of band gaps (open/closed) difficult by ARPES measurements alone. A team led by AIMR has developed a new technique for interpreting surface electronic-states characterizations by modeling ARPES data using a Bayesian inference. The team applied this technique to the band gap of $TlBi(S,Se)_2$ having Dirac cone characteristics and finally reached the conclusion that the band gap of this material is opened (Dirac cones are gapped). With the help of mathematical techniques such as Bayesian statistics, ARPES will become more advanced and more powerful in the future.

5. Katsuaki Sugawara, Haruki Kusaka, Tappei Kawakami, Koki Yanagizawa, Asuka Honma, Seigo Souma, Kosuke Nakayama, Masashi Miyakawa, Takashi Taniguchi, Miho Kitamura, Koji Horiba, Hiroshi Kumigashira, Takashi Takahashi, Shin-ichi Orimo, Masayuki Toyoda, Susumu Saito, Takahiro Kondo, and Takafumi Sato, Direct imaging of band structure for powdered rhombohedral boron monosulfide by microfocused ARPES. ***Nano Letters***, **23**, 1673-1679 (2023). DOI: 10.1021/acs.nanolett.2c04048

   [Band structure of powdered crystals by μ-ARPES (ATP1+ATP2)] Observing band structures of small or powdered crystals has long been a challenge in materials science. For example, the band structure of layered rhombohedral boron monosulfide (r-BS) has been hoped to be observed because of the significance of r-BS itself in materials science and engineering such as hydrogen storage, photocatalysis, and high-T_c superconductivity. The joint team of ATP1 and ATP2 at AIMR achieved this by first dispersing r-BS powder onto a Au substrate in a ultrahigh-vacuum and cleaving the sample to obtain clean surfaces. The team then used optical microscopy and scanning μ-ARPES to select the ideal r-BS powder crystals for the local ARPES measurements. This new observation technique will lead us to the universal methodology to investigate the band structure and fermiology of a wide variety of samples including powdered crystals.

6. Yuki Nakata, Katsuaki Sugawara, Ashish Chainani, Hirofumi Oka, Changhua Bao, Shaohua Zhou, Pei-Yu Chuang, Cheng-Maw Cheng, Tappei Kawakami, Yasuaki Saruta, Tomoteru Fukumura, Shuyun Zhou (Tsinghua U), Takashi Takahashi, and Takafumi Sato, Robust charge-density wave strengthened by electron correlations in monolayer 1T-$TaSe_2$ and 1T-$NbSe_2$. ***Nature Communications***, **12**, 5873 (2021). DOI: 10.1038/s41467-021-26105-1

   [Mottronics (ATP1+International collaboration with Satellite at Tsinghua U.)] Mott insulator is a phase that emerges when the electron correlation (U) of a material significantly exceeds the width of its partially filled band (W). Mott insulator is important not only in physics but also in application to materials because of its remarkable functions. An international collaboration team comprising AIMR (ATP1) members and overseas satellite members at Tsinghua University investigated a room-temperature (RT), two-dimensional (2D) Mott-insulator phase of a single-layer 1T-$TaSe_2$ and 1T-$NbSe_2$ using ARPES. The team discovered that the enhancement of the Mott-transition temperature stems from the interplay between exotic quantum features and low dimensionality. These results open a pathway toward the realization of RT Mottronic devices and

high-temperature superconductors.

7. William N. Faugno and Tomoki Ozawa, Interaction-induced non-Hermitian topological phases from a dynamical gauge field. *Physical Review Letters*, **129**, 180401 (2022). DOI: 10.1103/PhysRevLett.129.180401

   [Stepping into a vast unexplored area in non-Hermitian topology (ATP1)] The theoretical physics team of AIMR found a non-Hermitian model which can describe the interaction inducing non-trivial topologies. The non-Hermitian gauge field depending on the density plays a major role; in the case of one particle, the density field is zero and is equivalent to Hermitian, and the energy is only the real part. However, as soon as the number of particles increases to two, the energy comes to possess an imaginary part without any additional treatment. The search for non-Hermitian systems has just begun, and like Hermitian systems, they are expected to have so many topological phases. Therefore, the discovery in this study is positioned as the first step in opening up this vast unexplored area and the team continues to move forward.

8. Georg Schusteritsch, Ryo Ishikawa, Abdul Razak Elmaslmane, Kazutoshi Inoue, Keith P. McKenna, Yuichi Ikuhara, and Chris J. Pickard, Anataselike grain boundary structure in rutile titanium dioxide. *Nano Letters*, **21**, 2745-2751 (2021). DOI: 10.1021/acs.nanolett.0c04564

   [Prediction of grain boundary structures (International collaboration with Satellite at U. Cambridge)] Grain boundaries (GBs) universally exist in ceramic materials and the atomic arrangement along a GB is different from that in a crystal far from the GB, leading to the potential to develop new properties and functions characteristic of GBs. The international collaboration team led by present and former members of AIMR took a synergistic approach to broaden the scope of the GB structure investigation. Combining scanning transmission electron microscopy (STEM) with *ab initio* random structure searching (AIRSS) which one of the authors of this paper (C.J. Pichard) had developed before, the team has discovered the existence of a structure having strong anatase character along GBs in bulk rutile TiO_2. This finding is surely the significant step toward understanding the gap existing between crystal structures and material properties of ceramics.

9. Mehrdad Elyasi, Eiji Saitoh, and Gerrit E. W. Bauer, Stochasticity of the magnon parametron. *Physical Review B*, **105**, 064403 (2022). DOI: 0.1103/PhysRevB.105.054403

   [Stochasticity of magnon parametron as "p-bit" (ATP1)] The team from AIMR explored the quantum statistics in magnetism and spintronics to uncover their potential applications in unconventional computing paradigms. The controlled stochastic switching observed in the magnon parametron makes it a promising candidate for probabilistic bit (p-bit) operations. Furthermore, at low temperatures, quantum effects are predicted to come into play. To understand the underlying physics of this phenomenon, the authors investigated the origin of the magnon parametron from the standpoint of thermal and quantum statistics and found that its stochastic switching (p-bit characteristics) experimentally observed at room temperature relates to Suhl instability of the uniform magnetization precession. The team is exploring a strategy to overcome magnetic damping which disturb the utilization of quantum effect in the stochastic switching.

10. Takuya Funatsu, Shun Kanai, Jun'ichi Ieda, Shunsuke Fukami, and Hideo Ohno, Local bifurcation with spin-transfer torque in superparamagnetic tunnel junctions, *Nature Communications*, **13**, 4079 (2022). DOI: 10.1038/s41467-022-31788-1

    [Local bifurcation in "p-bit" computing hardware (ATP1)] The team led by AIMR researchers focused thermal fluctuation of nanoscale magnetic tunnel junctions with spin-transfer torque (STT) and proposed new "p-bit (probabilistic bit)" computing; they also succeeded in executing some calculations using the developed circuits. However, such thermal fluctuation has aspect of Néel-Arrhenius law and its details are still controversial. In this study, the team approached the Néel-Arrhenius law with STT utilizing superparamagnetic tunnel junctions that have high sensitivity to external perturbations. The team showed that the results were comprehensively described by a concept of "local bifurcation" observed in various physical systems. These findings

demonstrate the capability of superparamagnetic tunnel junction as a useful tester for statistical physics as well as the sophisticated engineering of probabilistic computing hardware.

11. Di Zhang, Yutaro Hirai, Koki Nakamura, Koju Ito, Yasutaka Matsuo, Kosuke Ishibashi, Yusuke Hashimoto, Hiroshi Yabu, and Hao Li, Benchmarking pH-field coupled microkinetic modeling against oxygen reduction in large-scale Fe–azaphthalocyanine catalysts. *Chemical Science*, **15**, 5123-513 (March 2024). DOI: 10.1039/D4SC00473F

    [Dancing ORR catalyst predicted by computation (ATP2)] Although fuel cell technology has been hoped to lead to clean energy production, the insufficient efficiency of catalysts has hindered the widespread adoption of the fuel cells. In recent years, AIMR researchers have discovered new molecular metal-nitrogen-carbon (M-N-C) catalysts such as metal-doped azaphthalocyanine (AzPc) which enhance the oxygen reduction reaction (ORR) in fuel cells and have potential to replace platinum based catalysts. This time, experimental and computational researchers from ATP2 synthesized new type of M-N-C molecular catalyst and predicted the movement and configuration of the molecules adsorbed on graphene surfaces by DFT calculations. They found that the molecules take on three-dimensional shapes like a dancer placed onto a stage and this shape change influences the ORR catalytic efficiency of the molecules depending on pH levels.

12. Takaaki Tomai, Liangyu Tang, Akira Yoko, Yuki Omura, Gimyeong Seong, and Tadafumi Adschiri, Facile regeneration strategy for facet-controlled nanocatalysts via the dissolution−reprecipitation process promoted by an organic modifier. *Chemistry of Materials*, **33**, 7780-7784 (2021). DOI: 10.1021/acs.chemmater.1c02145

    [Facet-controlled nanocatalyst (ATP2)] An AIMR-led research team has combined the use of an organic modifier with supercritical hydrothermal treatment techniques to design a strategy to create facetted nanocatalysts. The team demonstrated this strategy by regenerating degraded cubic ceria (CeO_2) nanoparticles back to their original cubic shape. The team designed a regeneration approach aiming at reorienting active surface facets through partial dissolution-reprecipitation with a facet-selective organic modifier under supercritical hydrothermal conditions. Although the design involved complex particle-to-modifier interactions through partial dissolution and re-precipitation processes and it was difficult to predict the result, they could finally obtained particles with cubic shapes which were confirmed by TEM images. The team aims for the novel technology to develop recyclable nanocatalysts based on the achievement of this study.

13. Ryuhei Sato, Kazuto Akagi, Shigeyuki Takagi, Kartik Sau, Kazuaki Kisu, Hao Li, and Shin-ichi Orimo, Topological data analysis of ion migration mechanism. *The Journal of Chemical Physics*, **158**, 144116 (2023). DOI: 10.1063/5.0143387

    [Topological data analysis (ATP2)] Topological data analysis based on persistent homology is one of the mathematical tools which have brought AIMR a lot of success in the past decade. This time, AIMR researchers applied this tool to the molecular dynamics (MD) simulation for the fast ion-conducting phase (α-phase) of AgI to show its effectiveness on the ion migration mechanism. Time-averaged persistence diagrams of α-AgI showed the emergence of the four-membered rings formed by two Ag and two I ions at high temperatures. Those rings were identified as common structures during the Ag ion migration, and the deformation of the rings during Ag migration was found to be closely related to the ion conductivity. The concerted motion of two Ag ions via the four-membered ring was also extracted from MD simulated results. This suggests that the approach provides new insight into the specific mechanism of the concerted motion in ion conductors.

14. Wei Yu, Takeharu Yoshii, Alex Aziz, Rui Tang, Zheng-Ze Pan, Kazutoshi Inoue, Motoko Kotani, Hideki Tanaka, Eva Scholtzová, Daniel Tunega, Yuta Nishina, Kiho Nishioka, Shuji Nakanishi, Yi Zhou, Osamu Terasaki, and Hirotomo Nishihara, Edge-site-free and topological-defect-rich carbon cathode for high-performance lithium-oxygen batteries. *Advanced Science*, **10**, 2300268 (2023). DOI: 10.1002/advs.202300268

    [Topological-defect-rich carbon for batteries (ATP2)] Lithium-oxygen batteries (LOBs) hold great potential as the next-generation energy-storage devices due to their high theoretical energy

densities. A team led by AIMR researchers including mathematicians applied graphene mesosponge (GMS), which was developed by some of the members of this team in 2016, to the cathodes of LOBs and found the improvement of discharge capacities compared to conventional carbon cathodes. In this study, the team focused on the mechanism of the increase of catalytic activity by GMS. In situ isotopic electrochemical mass spectrometry and theoretical calculations revealed that a large amount of topological-defects in GMS enhance the formation of amorphous Li_2O_2, which leads to improved cycle performance. Future directions will focus on the design of free-standing and highly porous cathodes to realize practical high-performance LOBs.

15. Kazuo Takimiya, Kirill Bulgarevich, Shingo Horiuchi, Aoi Sato, and Kohsuke Kawabata, Bandlike versus temperature-independent carrier transport in isomeric diphenyldinaphtho[2,3-*b*:2′,3′-*f*]thieno[3,2-*b*]thiophenes. ***ACS Materials Letters***, **4**, 675-681 (2022). DOI: 10.1021/acsmaterialslett.2c00084

    [Future organic semiconductor design (ATP3)] Many kinds of organic semiconductors (OSCs) exhibit a high degree of molecular motion even at low temperatures. This type of dynamic disorder locally affects charge transfers, and globally affects the materials electronic properties. In this study, based on the comparison between the carrier mobilities measured using single-crystal field-effect transistors (FETs) and simulated results of the dynamic disorder using the band-like model of two dinaphthothienothiophene (DNTT) regioisomers, the team found that the transport properties of OSCs are correlated with their susceptibilities to molecular motions. The two DNTTs cannot be distinguished by using traditional thin-film FETs and the static hopping model. The new result not only supports the novel dynamic picture, but also suggests the dynamic disorder simulation technique is useful as a complementary tool for designing the next high-performance OSCs

16. Peizhao Liu, Yann Battie, Takaki Kimura, Yutaka Okazaki, Piyanan Pranee, Hao Wang, Emilie Pouget, Sylvain Nlate, Takashi Sagawa, and Reiko Oda, Chiral perovskite nanocrystal growth inside helical hollow silica nanoribbons. ***Nano Letters***, **23**, 3174-3180 (2023). DOI: 10.1021/acs.nanolett.2c04823

    [Crystallization in helical nano-cage (ATP3)] It is difficult to fabricate mesoscopic structures with precise morphologies because the scale of these objects lies just out of reach of the capabilities of both traditional bottom-up and top-down fabrication methods. The team led by AIMR researchers tried a unique approach that utilizes the nanospace within self-assembled nanometric helical silica ribbons as templates for growing perovskite nanocrystals (PNCs) by recrystallization. Using supersaturated solutions of Cs^+, Pb^{2+}, and Br^- precursors, the grown helical PNCs not only had precise chiral morphologies at nanometric level but also showed remarkable chiroptical properties, including strong circular dichroism and strong induced circularly polarized luminescence. A future direction will use this approach to fabricate 2D or 3D supra-object structures and contribute to the development of chiral optics.

17. Michael I. Ojovan and Dmitri V. Louzguine-Luzgin, On structural rearrangements during the vitrification of molten copper. ***Materials***, **15**, 1313 (2022). DOI: 10.3390/ma15041313

    [Amorphous materials: Towards understanding the glass-transition phenomenon (ATP3)] Amorphous/glassy materials have superior mechanical, chemical, biological, and magnetic properties because of their unique structures and lack of long-range order. However, these unique structural features also make the formative processes of amorphous materials such as glass-transition difficult to understand. Recently, the team led by an AIMR researcher worked on liquid-to-glass transitions by combination of molecular dynamics simulations, theoretical calculations, and X-ray diffraction measurements to clarify the structural changes of cooling Cu melts in terms of configurons (broken Cu–Cu bonds). This strategy was able to depict the reverse transition of Cu from glass to the supercooled liquid state on heating as the onset of configuron percolation clusters. This finding also give us a clue to understanding about liquid fragility.

18. Keikuke Yamagishi, K. Onyam, Yukiko Ogawa, Daisuke Ando, and Yuji Sutou, Abnormal grain

growth through cyclic heat treatment in a Mg–Sc alloy. *Journal of Alloys and Compounds*, **938**, 168415 (2023). DOI: 10.1016/j.jallcom.2022.168415

[Toward biocompatible shape memory alloys (ATP3)] Mg-Sc alloys with extremely low densities and inherent biocompatibility have become promising candidates as the next-generation shape memory alloys (SMAs), and the understanding of shape memory mechanism of Mg-based alloys is important. A team led by an AIMR researcher addressed this problem by focusing on the effects of abnormal grain growth on the superelasticity of polycrystalline Mg-Sc alloys. Grain enlargement is a known approach to improving superelasticity in conventional Cu- and Fe-based SMAs. The team used cyclic heat treatment (CHT) to investigate the mechanism of the abnormal grain growth leading to the improvement of the alloys' superelasticity. The analysis revealed that the control of heating conditions (e.g., heating rate, temperature, and holding time) actually resulted in the change of grain growth and the improvement of superelasticity.

19. Takuma Sumi, Hideaki Yamamoto, Yuichi Katori, Koki Ito, Satoshi Moriya, Tomohiro Konno, Shigeo Sato, and Ayumi Hirano-Iwata, Biological neurons act as generalization filters in reservoir computing. *Proc. Natl. Acad. Sci. USA*, **120**, 37307467 (2023). DOI: 10.1073/pnas.2217008120

    [Biological neurons acting as generalization filters in RC (ATP3)] Although recurrent networks of neuronal cells in a brain are represented by simplified mathematical models of artificial neural networks, they are not necessarily identical. To clarify this issue, a team led by AIMR researchers used reservoir computing (**RC**) to readout the stimulus responses of cultured neuronal networks and evaluated their computational properties in pattern classification. The team used optogenetics and calcium imaging to record the multicellular responses of cultured biological neuronal networks (BNNs) and employed the **RC** to decode their computational capabilities. The team showed that reservoirs of biological neurons filter input signals, which can be classified by a linear decoder and that modularity in the recurrent connectivity facilitate the classification. The result suggests that BNNs act as a generalization filter which improves **RC** performance.

20. Ganhua Xie, Pei Li, Paul Y. Kim, Pei-Yang Gu, Brett A. Helms, Paul D. Ashby, Lei Jiang, and Thomas P. Russell, Continuous, autonomous subsurface cargo shuttling by nature-inspired meniscus-climbing systems. *Nature Chemistry*, **14**, 208-215 (2022). DOI: 10.1038/s41557-021-00837-5

    [Liquid robotics (ATP3)] An AIMR-led research team designed a liquid-robot system which can autonomously transport cargo from a pickup to a drop-off location repeatedly without external energy input. The team crossed the physics of insect meniscus-climbing mechanics with the chemistry of aqueous two-phase systems to fabricate droplet robots. The team placed a dextran droplet at the surface of a salt-laden polyethylene-glycol (PEG) solution in a test tube. Initially, the droplet glided up the PEG meniscus to the test-tube wall; as its density increased through salt extraction, the droplet glided down the meniscus back to the test-tube center. Using this mechanism, the team implemented propulsion, autonomy, and task design. Although the previous studies only demonstrated liquid robots performing a task once without external energy, the new design in this study broke this barrier with the help of chemistry to control an object's buoyancy.

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

*List up to 10 main presentations made between FY 2020 and FY 2023 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
February 14, 2024	Shunsuke Fukami PI	Electrical control of noncollinear antiferromagnetic Mn_3Sn (Keynote talk)	International Symposium on Quantum Electronics 2024 (Tokyo, Japan)
December 1, 2023	Hao Li Junior PI	The Cat-Universe: A "data-theory-methodology-experiment" framework to realize catalyst design (Keynote talk)	International Symposium on Green Transformation of Carbon Dioxide (ISGTCO2) (Brisbane, Australia)
September 26, 2023	Kazuo Takimiya PI	Crystal structures of molecular semiconductors: control and prediction (Invited talk)	Horizons symposium: Electronic & energy materials (Berlin, Germany)
September 12, 2023	Tadafumi Adschiri PI	Synthesis of substituted petroleum by hydrothermal reaction of biomass - Combining pulp & paper industry and chemical industry toward carbon neutral society (Awarded/Keynote lecture)	International Solvothermal and Hydrothermal Association Conference 2023 (ISHA2023) (Valladolid, Spain)
August 8, 2023	Shigemi Mizukami PI	Exploring advanced materials for spintronics (Invited talk)	Spintronics and Quantum Transformation (Spin-QX 2023) (Julich, Germany)
July 27, 2023	Reiko Oda PI	Transferring chiral information between objects with different dimensions without crystalline order (Plenary talk)	33rd International Symposium on Chirality (CHIRALITY 2023) (Rome, Italy)
June 1, 2023	Hiroshi Suito PI	A matching algorithm for incomplete trees for diagnosis of bronchiectasis (Invited talk)	Emerging Technologies in Computational Science for Industry, Sustainability and Innovation - Math 2 Product (M2P) 2023 (Taormina, Sicily, Italy)
February 1, 2023	Hirotomo Nishihara PI	Graphene mesosponge: Graphitized and highly mesoporous graphene with high durability and sponge-like flexibility (Plenary talk)	1st International Symposium on Carbon Materials (2023 ISCM-1) (Tainan, Taiwan)
January 25, 2023	Shin-ichi Orimo PI	Super-ionic conduction of mono-/di-valent cations and advanced battery application of complex hydrides: viewpoint from "HYDROGENOMICS" project (Plenary talk)	15th International Symposium Hydrogen & Energy (Emmetten, Switzerland)
August 23, 2022	Hiroshi Yabu PI	Polymer self-assembly under 3D confinement (Invited talk)	American Chemical Society (ACS) Fall Meeting 2022 (Chicago, USA)

3. Major Awards

*List main awards received between FY 2020 and FY 2023 in order from the most recent (within 10 awards)..
*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 21-24, 2024	Prof. Gerrit Ernst-Wilhelm Bauer, PI at AIMR	Humboldt Research Award
September 11, 2023	Prof. Tadafumi Adschiri, PI at AIMR	International Solvothermal and Hydrothermal Association (ISHA) Lifetime Award 2023
June 12, 2023	Prof. Yuichi Ikuhara, PI at AIMR and Prof. Naoya Shibata (The University of Tokyo)	The 113th Japan Academy Prize
February 7, 2023	Prof. Shunsuke Fukami, PI at AIMR	The 19th (FY2022) JSPS Prize
December 6, 2022	Prof. Eiji Saitoh, PI at AIMR	The 68th Nishina Memorial Prize (Nishina Memorial Foundation)
November 30, 2022	Prof. Tadafumi Adschiri, PI at AIMR	The 22nd Yamazaki-Teiichi Prize (Foundation for Promotion of Material Science and Technology of Japan)
June 27, 2022	Prof. Eiji Saitoh, PI at AIMR	The 112th Japan Academy Prize
October 29, 2021	Professor Emeritus Katsumi Tanigaki (former PI at AIMR)	The 15th Beijing Great Wall Friendship Award
May 28, 2021	Prof. Shin-ichi Orimo, PI and Director of AIMR	The 18th Honda Frontier Award
Announced on December 17th, 2020	Prof. Hirotomo Nishihara, PI of AIMR	The 17th (FY2020) JSPS Prize

Appendix 2 FY 2023 List of Principal Investigators

NOTE:

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

*Indicate newly added researchers for FY 2020-2023 in the "Notes" column.

		<Principal Investigators at the end of FY 2023>				**Principal Investigators Total: 28**	
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	58	Professor, AIMR, Tohoku University	Ph.D. / Materials science (Energy devices)	80%	From Jan. 2013	Usually stays at the center	
Deputy Center Director Hiroshi Suito	62	Professor, AIMR, Tohoku University	Ph.D. / Mathematics (Numerical analysis)	80%	From Apr. 2017	Usually stays at the center	
Tadafumi Adschiri	66	Professor, AIMR, Tohoku University	Doctor of Engineering / Materials science (Supercritical hydrothermal synthesis)	80%	From start	Usually stays at the center	
Gerrit Bauer	68	Professor, AIMR, Tohoku University	Ph.D. / Condensed matter physics (Theory)	80%	From Apr. 2020	Usually stays at the center	Appointed to PI on Apr. 2020
Hayato Chiba	42	Professor, AIMR, Tohoku University	Ph.D. / Mathematics (Dynamical systems)	80%	From Apr. 2019	Usually stays at the center	
Shunsuke Fukami	43	Professor, Research Institute of Electrical Communication (RIEC), Tohoku University	Ph.D. / Applied physics (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	
Ayumi Hirano	54	Professor, Research Institute of Electrical Communication (RIEC), Tohoku University	Ph.D. / Bio-devices	40%	From Oct. 2016	Usually stays at RIEC, close to the center, and participate in the center's activities	
Motoko Kotani	64	Professor, AIMR, Tohoku University (Advisor to the Center Director)	Doctor of Science / Mathematics (Geometry)	20%	From March 2010	Usually stays at the center	
Dmitri Valentinovich Louzguine	56	Professor, AIMR, Tohoku University cross-appointment: AIST-TohokuU Mathematics for Advanced Materials Open Innovation Laboratory (MathAM-OIL)	Ph.D. / Materials science (Metallic glasses)	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	51	Professor, AIMR, Tohoku University	Ph.D. / Applied physics (Spintronics)	80%	Assist. (Assoc.) Prof.: From Apr. 2008 Professor and PI: From Nov. 2014	Usually stays at the center	
Hirotomo Nishihara	46	Professor, AIMR, Tohoku University	Ph.D. / Materials science (Energy devices)	80%	From Apr. 2020	Usually stays at the center	Appointed to PI on Apr. 2020
Takafumi Sato	49	Professor, AIMR, Tohoku University	Ph.D. / Condensed matter physics (Electron spectroscopy)	80%	From Apr. 2019	Usually stays at the center	
Hiroshi Yabu	47	Professor, AIMR, Tohoku University	Ph.D. / Materials science (Energy devices)	80%	From Apr. 2023	Usually stays at the center	Promoted to PI on Apr. 2023
Yuji Sutou	49	Professor, School of Engineering, Tohoku University	Ph.D. / Materials science (Functional devices)	40%	From Apr. 2021	Usually stays at Graduate Shcool of Engineering, and participate in the center's activities	Appointed to PI on Apr. 2021
Kazuo Takimiya	57	Professor, School of Engineering, Tohoku University	Ph.D. / Organic synthetic chemistry	40%	From Apr. 2021	Usually stays at Graduate Shcool of Science, and participate in the center's activities	Appointed to PI on Apr. 2021
Yuichi Ikuhara	64	Professor, School of Engineering, Institute of Engineering Innovation, The University of Tokyo	Doctor of Engineering / Materials science (Ceramics)	30%	From start	Stays at the center once a month	
Eiji Saitoh	52	Professor, Department of Applied Physics, School of Engineering, The University of Tokyo	Ph.D. / Condensed matter physics (Spin transport)	30%	From Apr. 2012	Stays at the center once a month	Moved to the University of Tokyo (cross-appointment)
Yong P. Chen	44	Professor, Department of Physics and School of Electrical and Computer Engineering, Purdue University	Ph.D. / Condensed matter physics (Quantum phenomena)	20%	From Apr. 2017	・Stays at center three times (more than two months in total) a year. ・Attends the AIMR conference	
Alan Lindsay Greer	68	Professor, Department of Materials Science & Metallurgy, University of Cambridge	Ph.D. / Materials science (Metallic glasses)	20%	From start	・Stays at the center once a year ・Attends the AIMR conference	
Chris Pickard	50	Professor, Department of Materials Science & Metallurgy, University of Cambridge	Ph.D. / Condensed matter physics (First-principles calculation)	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	71	Professor, Department of Polymer Science and Technology, University of Massachusetts Amherst	Ph.D. / Materials science (Polymers)	20%	From start	・Stays at the center once a year ・Attends the AIMR conference	

Alexander Shluger	69	Professor, Department of Physics and Astronomy, University College London (UCL)	Ph.D. / Condensed matter physics (First-principles calculation)	20%	From start	・Stays at the center once a year ・Attends the AIMR conference	
Magda Titirici	47	Professor, Department of Chemical Engineering, Imperial College London	Ph.D. / Materials science (Energy devices)	20%	From Apr. 2021	・Stays at the center once a year ・Attends the AIMR conference	Appointed to PI on Apr. 2021
Qi-kun Xue	60	President, Southern University of Science and Technology (SUSTech) / Professor, Department of Physics, Tsinghua University	Ph.D. / Condensed matter physics (Quantum phenomena)	20%	From start	・Dispatchs a PD Researcher ・Attends the AIMR conference	
Rana Mohtadi	49	Senior Principal Scientist. Materials Research Department, Toyota Research Institute of North America	Ph.D./ Materials science (Energy devices)	20%	From Apr. 2022	・Stays at the center once a year ・Attends the AIMR conference	Appointed to PI on April 1st, 2022
Reiko Oda	58	Research Director, UMR 5248 CBMN, CNRS	Ph.D./ Materials science (Chiral molecular assembly)	20%	From Apr. 2022	・Stays at center more than three months in total a year. ・Attends the AIMR conference	Appointed to PI on April 1st, 2022
Michael Hirscher	66	Group Leader, Hydrogen Storage, Max Planck Institute for Intelligent Systems	Ph.D. / Materials science (Energy devices)	20%	From May 2022	・Stays at the center once a year ・Attends the AIMR conference	Appointed to PI on May 1st, 2022
Hyoung Seop Kim	59	Professor, Department of Materials Science and Engineering, Pohang University of Science and Technology	Ph.D. / Materials science (Science and engineering of alloys)	20%	From Aug. 2022	・Stays at the center once a year ・Attends the AIMR conference	Appointed to PI on August 1st, 2022

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

Principal Investigators resigned since FY 2020

Name	Next Affiliation (Position title, department, organization)	Period of participation

Appendix 3-1 Record of Center Activities (FY 2020-FY 2023)

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 numbers of researchers and staff members affiliated with AIMR and the positions postdoctoral researchers got after leaving AIMR, respectively.
- Prof. Yuji Sutou (School of Engineering, Tohoku University) and Prof. Kazuo Takimiya (School of Science, Tohoku University) were appointed to new PIs in 2021, and the fields of inorganic and organic materials for electronic devices have been strengthened.
- AIMR promoted Assoc. Prof. Hiroshi Yabu, Junior PI of AIMR, to a full professor and PI in 2023, hoping the expansion of innovation based on new catalysts his team developed.
- AIMR invited Prof. Magda Titirici (Imperial College London) as a foreign PI in 2021, and invited Dr. Rana Mohtadi (Toyota Research Institute of North America), Prof. Reiko Oda (Research Director of CNRS; University of Bordeaux), Dr. Michael Hirscher (Max Planck Institute for Intelligent Systems), and Prof. Hyoung Seop Kim (POSTECH) as foreign PIs in 2022. AIMR has arranged research space and staff (young researchers) of Prof. Oda's Laboratory and Prof. Kim's Laboratory at AIMR, and strongly supported the launch of their research in Sendai.
- AIMR employed Dr. Hao Li, a young and energetic researcher who had published many high impact papers in the United States and Europe, as Junior PI (associate professor) in 2022.
- In 2022-23, AIMR requested three energetic associate professors in Tohoku University, Dr. Tomohiro Otsuka (Research Institute of Electrical Communication), Dr. Toshiaki Kato (School of Engineering), and Dr. Kazutoshi Inoue (AIMR) to develop their laboratories at AIMR, hoping that they will become the leaders of the next-generation.
- AIMR employed Dr. Lewis Conway as the postdoctoral researcher of Joint Research Center (JRC) at University of Cambridge in 2022 and employed Dr. Hongyun Zhang as the postdoctoral researcher of JRC at Tsinghua University in 2023, and accelerated international collaboration through overseas satellite institutions (JRCs).

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	Christopher James Pickard, Alan Lindsay Greer	UK
The University of Chicago		US
Tsinghua University	Qikun Xue (SUSTech/Tsinghua U)	China

< Partner institutions>

Institution name	Principal Investigator(s), if any	Notes
University College London (UCL)	Alexander Shluger	UK
University of Massachusetts Amherst	Thomas P. Russell	US
Purdue University	Yong P. Chen	US
University of California, Los Angeles (UCLA)		US
Imperial College London (ICL)	Magda Titirici	UK
Max Planck Institute for Intelligent Systems	Michael Hirscher	Germany
Pohang University of Science and Technology (POSTECH)	Hyoung Seop Kim	Korea

2. Status of Collaboration with Overseas Satellites

2-1. Coauthored Papers

- List the refereed papers published between FY 2020 and FY 2023 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: **9** papers)

1) (157; **the paper number in Attachment A**) Ong, Zhun-Yong; *Schusteritsch, Georg* (JRC postdoc); *Pickard, Chris J.*, Structure-specific mode-resolved phonon coherence and specularity at graphene grain boundaries. Phys. Rev. B **101**, 195410 (2020). DOI: 10.1103/PhysRevB.101.195410
2) (216) van Driel, J.; *Schusteritsch, G.* (JRC postdoc); Brodholt, J. P.; Dobson, D. P.; *Pickard, C. J.*, The discontinuous effect of pressure on twin boundary strength in MgO. Phys. Chem. Miner. **47**, 11 (2020). DOI: 10.1007/s00269-019-01079-1
3) (392) Louzguine-Luzgin, D., V; Trifonov, A. S.; *Ivanov, Yu P.*; Lu, A. K. A.; Lubenchenko, A., V; *Greer, A. L.*, Shear-induced chemical segregation in a Fe-based bulk metallic glass at room temperature. Sci. Rep. **11**, 13650 (2021). DOI: 10.1038/s41598-021-92907-4
4) (423) *Nelson, Joseph R.* (JRC postdoc); Needs, Richard J.; *Pickard, Chris J.*, Navigating the Ti-C-O and Al-C-O ternary systems through theory-driven discovery. Phys. Rev. Mater. **5**, 123801 (2021). DOI: 10.1103/PhysRevMaterials.5.123801
5) (470) *Schusteritsch, Georg* (former JRC postdoc); Ishikawa, Ryo; Elmaslmane, Abdul Razak; Inoue, Kazutoshi; McKenna, Keith P.; Ikuhara, Yuichi; *Pickard, Chris J.*, Anataselike Grain Boundary Structure in Rutile Titanium Dioxide. Nano Lett. **21**, 2745-2751 (2021). DOI: 10.1021/acs.nanolett.0c04564
6) (634) *Ivanov, Yu P.*; Semin, V. O.; Lu, Z.; Jiang, J.; *Greer, A. L.*; Louzguine-Luzgin, D., V, Long-range-diffusion-assisted but interface-controlled crystallization of a Mg-Ni-Mm glass below its glass-transition temperature. J. Alloy. Compd. **909**, 164732 (2022). DOI: 10.1016/j.jallcom.2022.164732
7) (1021) Louzguine-Luzgin, D. V.; *Ivanov, Yu. P.*; *Greer, A. L.*, Separate primary crystallization of three crystalline phases in a nearly eutectic $Cu_{58}Y_{37}Sc_5$ metallic glass on heating and deformation. J. Alloy. Compd. **960**, 170618 (2023). DOI: 10.1016/j.jallcom.2023.170618
8) (976) *Kim, Sun-Woo*; *Conway, Lewis J.* (JRC postdoc); *Pickard, Chris J.*; Pascut, G. Lucian; *Monserrat, Bartomeu*, Microscopic theory of colour in lutetium hydride. Nat. Commun. **14**, 7360 (2023). DOI: 10.1038/s41467-023-42983-z
9) (1077) *Salzbrenner, Pascal T.*; *Joo, Se Hun*; *Conway, Lewis J.* (JRC postdoc); *Cooke, Peter I. C.*; Zhu, Bonan; Matraszek, Milosz P.; *Witt, William C.*; *Pickard, Chris J.*, Developments and further applications of ephemeral data derived potentials. J. Chem. Phys. **159**, 144801 (2023). DOI: 10.1063/5.0158710

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

1) (1227) *Wolfowicz, Gary* (former JRC postdoc); *Heremans, F. Joseph*; *Anderson, Christopher P.*; Kanai, Shun (associate member of AIMR); Seo, Hosung; Gali, Adam; *Galli, Giulia*; *Awschalom, David D.*, Quantum guidelines for solid-state spin defects. Nat. Rev. Mater. 6, 906-925 (2021). DOI: 10.1038/s41578-021-00306-y
2) (641) Kanai, Shun; *Heremans, F. Joseph*; Seo, Hosung; *Wolfowicz, Gary* (former JRC postdoc); *Anderson, Christopher P.*; Sullivan, Sean E.; Onizhuk, Mykyta; *Galli, Giulia*; *Awschalom, David D.*; Ohno, Hideo, Generalized scaling of spin qubit coherence in over 12,000 host materials. Proc. Natl. Acad. Sci. U. S. A. 119, e2121808119 (2022). DOI: 10.1073/pnas.2121808119

Overseas Satellite 3 Tsinghua University (Total: **2** papers)

1) (417) Nakata, Yuki; Sugawara, Katsuaki; Chainani, Ashish; Oka, Hirofumi; *Bao, Changhua*; *Zhou, Shaohua*; Chuang, Pei-Yu; Cheng, Cheng-Maw; Kawakami, Tappei; Saruta, Yasuaki; Fukumura, Tomoteru; *Zhou, Shuyun*; Takahashi, Takashi; Sato, Takafumi, Robust charge-density wave strengthened by electron correlations in monolayer 1T-$TaSe_2$ and 1T-$NbSe_2$. Nat. Commun. **12**, 5873 (2021). DOI: 10.1038/s41467-021-26105-1
2) (851) *Zhang, Hongyun*; Pincelli, Tommaso; Jozwiak, Chris; Kondo, Takeshi; Ernstorfer, Ralph; Sato, Takafumi; *Zhou, Shuyun*, Angle-resolved photoemission spectroscopy. Nat. Rev. Method.

Prim. **2**, 54 (2022). DOI: 10.1038/s43586-022-00133-7

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 2020-FY 2023. 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 2020	FY 2021	FY 2022	FY 2023	Total
Principal investigators	0	0	0	0	0
Other researchers	0	0	0	2	2
Total	0	0	0	2	2

<From overseas satellite>

	FY 2020	FY 2021	FY 2022	FY 2023	Total
Principal investigators	0	0	0	1	1
Other researchers	0	1	0	2	3
Total	0	1	0	3	4

Overseas Satellite 2: **The University of Chicago**

<To overseas satellite>

	FY 2020	FY 2021	FY 2022	FY 2023	Total
Principal investigators	0	0	0	0	0
Other researchers	0	0	0	2	2
Total	0	0	0	2	2

<From overseas satellite>

	FY 2020	FY 2021	FY 2022	FY 2023	Total
Principal investigators	0	0	0	0	0
Other researchers	0	0	0	7	7
Total	0	0	0	7	7

Overseas Satellite 3: **Tsinghua University**

<To overseas satellite>

	FY 2020	FY 2021	FY 2022	FY 2023	Total
Principal investigators	0	0	0	0	0
Other researchers	0	0	0	0	0
Total	0	0	0	0	0

<From overseas satellite>

	FY 2020	FY 2021	FY 2022	FY 2023	Total
Principal investigators	0	0	0	0	0
Other researchers	0	0	0	1	1
Total	0	0	0	1	1

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 2020 and FY 2023, and give up to **five examples** of the most representative ones using the table below.

FY 2020: **3** meetings	FY 2021: **6** meetings	FY 2022: **9** meetings	FY 2023: **7** meetings

Major examples (meeting titles, places and dates held)	Number of participants
Meeting Title: AIMR-Cambridge Workshop on Theoretical, Mathematical, Data-Driven Approaches in Materials Science Place: Tohoku University and University of Cambridge (Online) Date: April 20, 2022	From domestic institutions: 47 From overseas institutions: 31
Meeting Title: Tsinghua-SUSTech-AIMR Joint Workshop Place: Tohoku University, Tsinghua University and SUSTech (Online) Date: July 1, 2022	From domestic institutions: 26 From overseas institutions: 88
Meeting Title: 1st Tohoku-Bordeaux-Geneva Universities Joint Workshop Place: AIMR and IMRAM, Tohoku University (On-site) Date: November 11, 2022	From domestic institutions: 12 From overseas institutions: 8
Meeting Title: The 7th Symposium for the Core Research Clusters for Materials Science and Spintronics, and the 5th Symposium on International Joint Graduate Program in Materials Science Place: Tohoku University (On-Site/Hybrid) Date: November 28-December 1, 2023	From domestic institutions: 268 From overseas institutions: 33
Meeting Title: 2024 DTU-AIMR Catalyst Workshop: Catalyst Design for a Greener Tomorrow Place: Tohoku University and Technical University of Denmark (Online) Date: March 5, 2024	From domestic institutions: approx. 30 From overseas institutions: approx. 200

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
N/A		

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 2023 (March 31, 2024). Give five examples of the most representative agreements.

Number of effective agreements (as of March 31, 2024): **5**

Five examples of the most representative agreements:

1. Name of an Agreement: Agreement on Academic Exchange
   Dates of an Agreement: January 26, 2010
   Counterpart of an Agreement:
   Department of Materials Science and Metallurgy, University of Cambridge
   Summary of an Agreement:
   1) Promotion of joint research and educational activities
   2) Invitation to short-term visits of faculty members and researchers for lectures, conferences, colloquia, and symposia or other academic activities
   3) Exchange of information and pertinent publication in fields of interest to both universities
   4) 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 UChicago/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

4. Name of an Agreement: Memorandum of Understanding
   Dates of an Agreement: August 2, 2021
   Counterpart of an Agreement:
   Institute for Pure and Applied Mathematics (IPAM), University of California, Los Angeles (UCLA)
   Summary of an Agreement:
   1) Visits and informal exchanges of faculty, scholars and administrators in specific areas of education, research and outreach
   2) Organize joint conferences, symposia, or other scientific meetings on subjects of mutual interest
   3) Explore the possibilities for developing joint research programs and collaborations
   4) Other exchange and cooperation programs to which both parties agree

5. Name of an Agreement: Agreement on Academic Exchange
   Dates of an Agreement: January 18, 2011
   Counterpart of an Agreement:
   Department of Chemistry, University of Cambridge
   Summary of an Agreement:
   1) Promotion of joint research and educational activities
   2) Invitation to short-term visits of faculty members and researchers for lectures, conferences, colloquia, and symposia or other academic activities
   3) Exchange of information and pertinent publication in fields of interest to both universities
   4) Exchange of faculty members, researchers and students for study and research

5. Postdoctoral Positions through Open International Solicitations

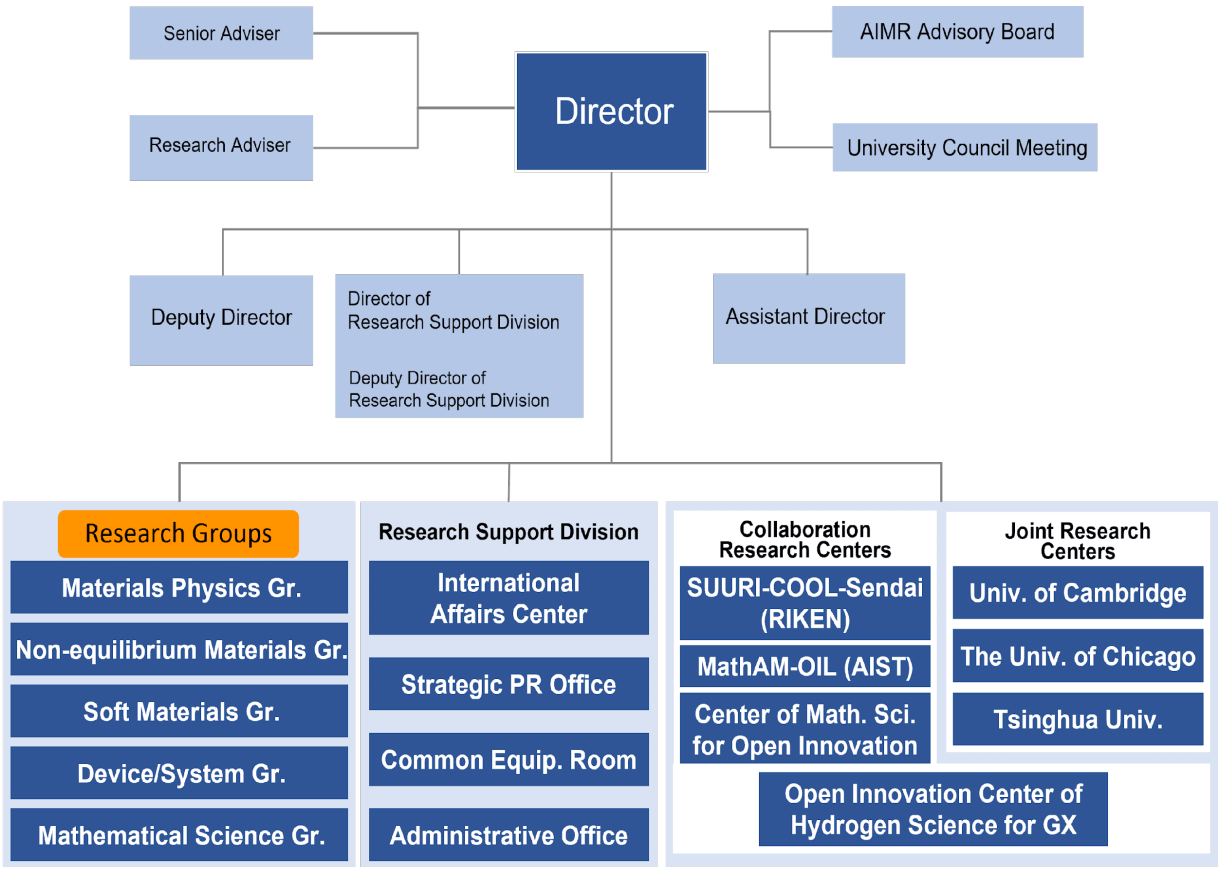
- In the columns "number of applications" and "number of selections," put the total number (upper) and the number and percentage of overseas researchers in the < > brackets (lower).
- In Appendix 3b, describe the status of employment of postdoctoral researchers.

Fiscal year	Number of applications	Number of selections
FY 2020	19	3
	〈 18, 94.7%〉	〈 2, 66.7%〉
FY 2021	42	8
	〈 30, 71.4%〉	〈 4, 50.0%〉
FY 2022	275	10
	〈248, 90.2%〉	〈 9, 90.0%〉
FY 2023	135	6
	〈120, 88.9%〉	〈 6, 100%〉

6. Diagram of Management System

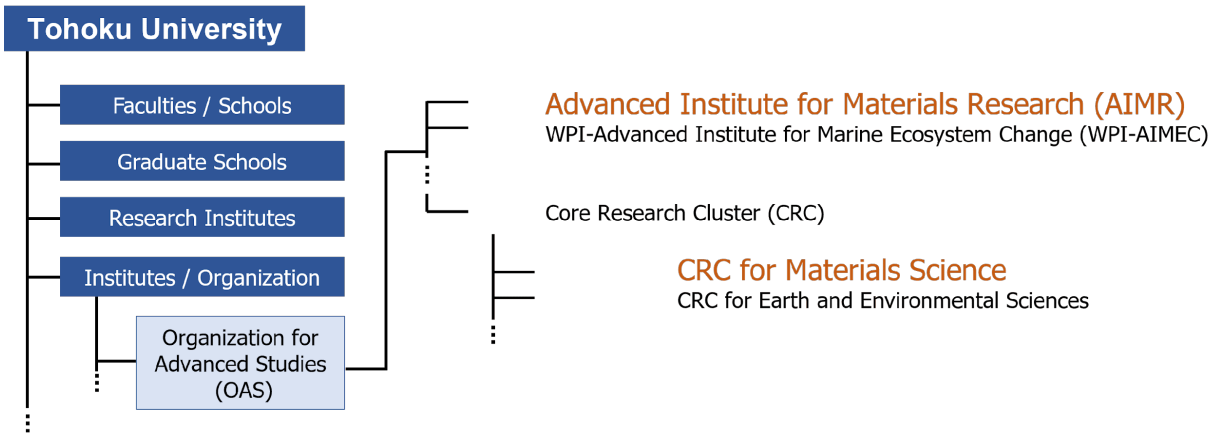
6-1.

- 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).



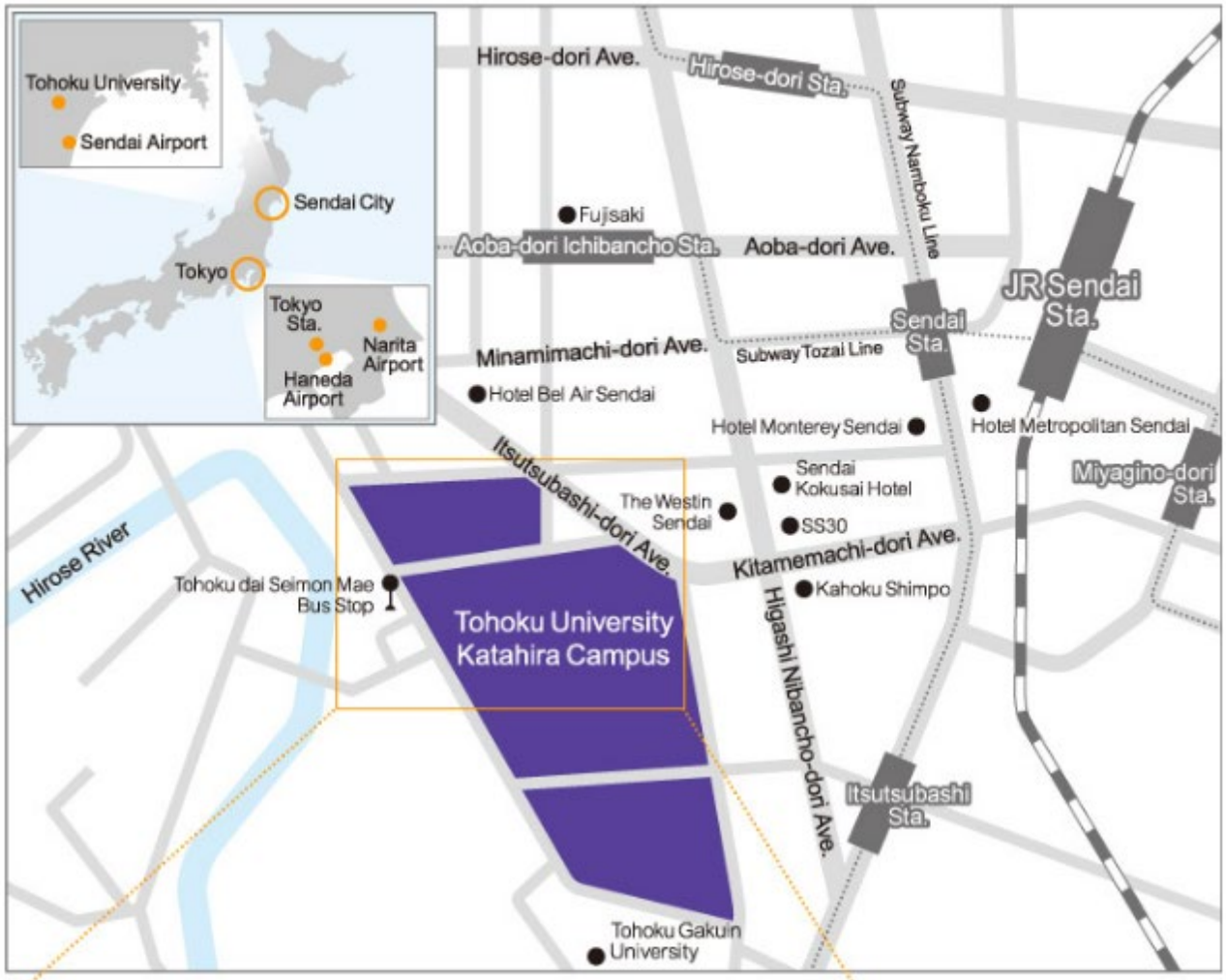
6-2.

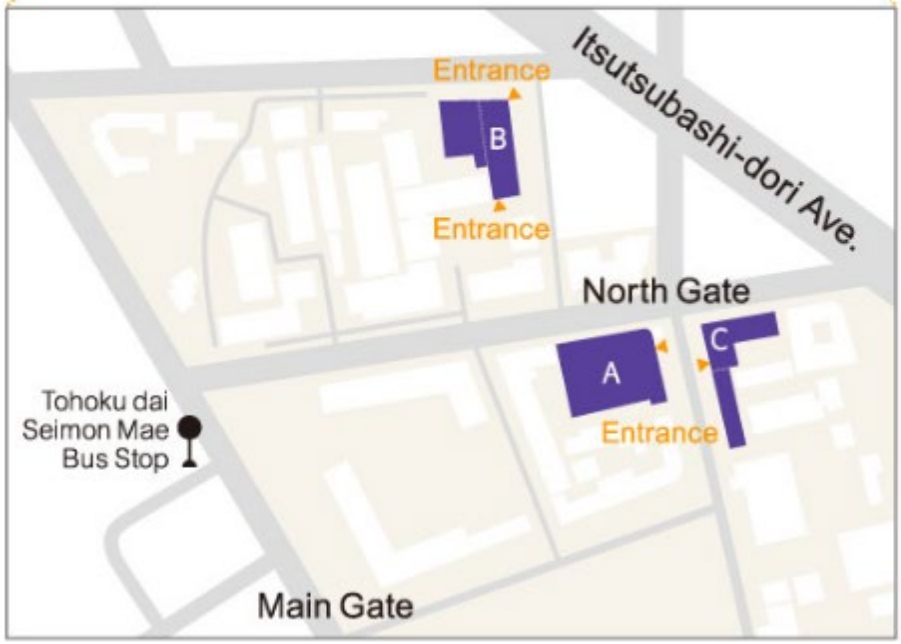
- Make a diagram of the organizational chart to show Center's position **within the host institution**.



7. Campus Map

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





A AIMR Main Building
B AIMR Laboratory Building
C AIMR Annex Building

Appendix3-1a Number of Center Personnel FY 2020-FY 2023

	FY 2020		FY 2021		FY 2022		FY 2023	
	Number of persons	%	Number of persons	%	Number of persons	%	Number of persons	%
Researchers	115		133		180		186	
Overseas researchers	46	40	59	44	95	53	101	54
Female researchers	14	12	22	17	34	19	41	22
Principal investigators (PIs)	24		27		29		28	
Overseas PIs	10	42	11	41	14	48	12	43
Female PIs	2	8	3	11	5	17	5	18
Other researchers	62		81		100		99	
Overseas researchers	19	31	36	44	46	46	46	46
Female researchers	7	11	14	17	16	16	22	22
Postdocs	29		25		51		59	
Overseas Postdocs	17	59	12	48	35	69	43	73
Female Postdocs	5	17	5	20	13	25	14	24
Research support staffs	43		49		57		45	
Administrative staffs	22		26		27		28	
TOTAL	180		208		264		259	

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

	FY 2020	FY 2021	FY 2022	FY 2023
Principal investigators (PIs)	16	18	17	17
Other researchers	46	41	40	37
Postdocs	2	2	1	1
Research support staffs	16	22	31	24
Administrative staffs	17	18	20	26

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

	FY 2020		FY 2021		FY 2022		FY 2023	
	Number of persons	%	Number of persons	%	Number of persons	%	Number of persons	%
Doctoral students	30		33		30		46	
Employed	3	10.0	1	3.0	5	16.7	1	2.2

※ The number of doctoral students indicated in the lower table can also include those in the upper table of Total numbers.

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.

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 2023.

* For each person, fill in the spaces to the right. More spaces may be added.

* Leave "Position as of April 2024" blank if unknown.

Japanese Postdocs

Employment period	Position before employed at WPI center		Next position after WPI center		Position as of April 2024*	
	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	Assistant technical director, JAMSTEC	JPN
2008.4.1 - 2011.3.31	Researcher, Nagoya Univ.	JPN	Researcher, East Tokyo Laboratory, Genesis Research Inst., Inc.	JPN	Staff of Tokyo Electron Limited working at Imec in Belgium	BEL
2008.4.1 - 2008.12.31	Researcher, Japan Atomic Energy Agency	JPN	Assistant Professor, Kyushu Inst. of Technology	JPN	Professor, Kyushu University	JPN
2008.4.1 - 2010.3.31	Ph.D. Student, Graduate School of Engineering, Tohoku Univ.	JPN	Researcher, TOSHIBA CORPORATION	JPN		
2008.4.1 - 2011.3.31	Researcher, Aaoyama Gakuin Univ.	JPN	Research Associate, Univ. of Virginia	USA	Specially-appointed Coordinator, Okayama Univ.	JPN
2008.5.1 - 2011.3.31	Researcher, Graduate School of Science, Tohoku Univ.	JPN	Researcher, TOSHIBA CORPORATION	JPN	CEO, buraitoai	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	Researcher, HOYA 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	Specially-appointed Assosicate Professor, 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	Associate Professor, Yamagata 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	CEO, Sigma-i Co., Ltd. / Visiting 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	Principal Researcher, Research Center for Emerging Computing Technologies, Advanced Industrial Science and Technology	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 Japan Research Institute, Inc.	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	Professor, Nagoya 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	Associate Professor, Shibaura Institute of Technology	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	Associate Professor, National Institute of Technology, Akita College	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	Leader, TDSE Inc.	JPN
2017.4.1 - 2018.1.31	Project Assistant Professor, Kyusyu Univ.	JPN	Researcher, Hokuetsu Corporation	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	Staff, TIA Promotion center, National Institute of Advanced Industrial Science and Technology (AIST)	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	Post-doc, 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	Associate Professor, Tokyo Metropolitan University	JPN
2012.5.1 - 2017.3.31	Ph.D. Student, The Univ. of Tokyo	JPN	Special Postdoctoral Researcher, RIKEN	JPN	Researcher, RIKEN	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	Associate 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
2011.4.1 - 2013.3.31	Postdoctoral Research Associate, WPI-MANA, National Institute for Materials Science (NIMS)	JPN	Postdoctoral Research Associate, Graduate School of Environmental studies, Tohoku Univ.	JPN	Professor, Department of Electrical and Electronic Engineering, Chiba Institute of Technology	JPN

2014.6.1 - 2016.9.31	Research Assistant, Graduate School of Science, Tohoku Univ.	JPN	Assistant Professor, WPI-AIMR, Tohoku Univ.	JPN	Associate Professor, WPI-AIMR, Tohoku Univ.	JPN
2019.04.01 - 2020.9.30	Research Fellowship for Young Scientists, JSPS	JPN	Lecturer, National Defense Academy of Japan	JPN	Lecturer, National Defense Academy of Japan	JPN
2017.07.01 - 2021.2.28	none		Assistant Professor, Utsunomiya Univ	JPN	Lecturer, Tokushima Univ.	JPN
2018.09.01 - 2021.3.31	Postdoc, Univ. of Bonn	DEU	Associate Professor, Saitam Univ.	JPN	Associate Professor, Saitam Univ.	JPN
2017.04.01 - 2021.3.31	Ph.D. Student, The Univ. of Tokyo	JPN	Assistant Professor, Josai Univ.	JPN	Assistant Professor, Josai Univ.	JPN
2018.04.01 - 2021.3.31	Ph.D. Student, School of Engineering, Tohoku Univ.	JPN	Research Scientsit, AIST	JPN	Research Scientsit, AIST	JPN
2020.04.01 - 2022.04.01	Assistant Professor, Graduate School of Science, Tohoku Univ.	JPN	Associate Professor, School of Engineering, Tohoku Univ.	JPN	Associate Professor, School of Engineering, Tohoku Univ.	JPN
2020.04.01 - 2022.06.30	Research Fellowship for Young Scientists, JSPS	JPN	Postdoc Researcher, AIST	JPN	Postdoc Researcher, AIST	JPN
2021.06.01 - 2022.09.30	Max Planck Institute for Mathematics	DEU	Assistant Professor, Kyushu Univ.	JPN	Assistant Professor, Kyushu Univ.	JPN
2020.09.01 - 2023.03.31	Research Fellowship for Young Scientists, JSPS	JPN	Assistant Professor, The Univ. of Tokyo	JPN	Assistant Professor, The Univ. of Tokyo	JPN
2018.10.01 - 2023.03.31	Collaborative Researcher, The Univ. of Tokyo	JPN	Research Fellow, Musashino Univ.	JPN	Research Fellow, Musashino Univ.	JPN
2021.06.30 - 2023.03.31	Technical Staff, AIST-TU MathAM-OIL	JPN	KDDI Research, Inc.	JPN	KDDI Research, Inc.	JPN
2021.04.01 - 2023.03.31	Ph.D. Student, Hokkaido Univ.	JPN	Assistant Professor, FRIS, Tohoku Univ.	JPN	Assistant Professor, FRIS, Tohoku Univ.	JPN
2018.04.01 - 2021.5.31	Specially Appointed Assistant Professor, Tokyo Univ. of Agriculture and Technology	JPN	Assistant Professor, Inst. for Materials Research, Tohoku Univ.	JPN	Associate Professor, Shibaura Institute of Technology	JPN

2018.03.20 - 2021.12.31	Research Associate, Harvard University	USA	Specially Appointed Associate Professor, Univ. of Tokyo	JPN	Specially Appointed Associate Professor, Univ. of Tokyo	JPN
2019.04.01 - 2022.3.31	Specially Appointed Assistant Professor, School of Engineering, Tohoku Univ.	JPN	Assistant Professor, Tokyo Univ. of Science	JPN	Associate Professor, Toyo Univ.	JPN
2021.04.01 - 2022.3.31	Research Fellowship for Young Scientists, JSPS	JPN	Special Postdoctoral Researcher, RIKEN	JPN	Assistant Professor, The Univ. of Tokyo	JPN
2014.04.01 - 2022.3.31	Researcher, Univ. of Tsukuba	JPN	Researcher, JAEA	JPN	Researcher, JAEA	JPN
2020.05.01 - 2022.3.31	Ph.D. Student, The Univ. of Tokyo	JPN	Postdoctoral Researcher, MathAM-OIL	JPN	Special Postdoctoral Researcher, AIST	JPN
2021/06.30 - 2023.08.31	Special Postdoctoral Researcher, AIST	JPN	Assistant Professor, Aoyama Gakuin Univ.	JPN	Assistant Professor, Aoyama Gakuin Univ.	JPN
2018.01.01 - 2024.03.31	Lecturer (part-time), Kyoto Univ.	JPN	Specially Appointed Lecturer, Univ. of Toyama	JPN	Specially Appointed Lecturer, Univ. of Toyama	JPN
2021.04.01 - 2024.03.31	Research Fellowship for Young Scientists, JSPS	JPN	Associate Professor, Doshisha Univ.	JPN	Associate Professor, Doshisha Univ.	JPN
2022.01.01 - 2024.03.31	Project Researcher, The Univ. of Tokyo	JPN	Assistant Professor, The Univ. of Tokyo	JPN	Assistant Professor, The Univ. of Tokyo	JPN
2022.04.01 - 2024.03.31	Researcher, Tokyo Inst. Of Technology	JPN	Engineer, SOLIZE Corporation	JPN	Engineer, SOLIZE Corporation	JPN
2020.07.01 - 2024.03.31	Postdoc, Technical University of Denmark	DNK	3D Architech Inc.	JPN	3D Architech Inc.	JPN

Overseas Postdocs

Employment period	Position before employed at WPI center		Next position after WPI center		Position as of April 2024*		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	Professor, Institute of Chemistry, Chinese Academy of Sciences	CHN	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	Founder and Researcher, Effectual Learning	QAT	IND
2009.5.13 - 2009.8.31	Senior Researcher, Ural State Univ.	RUS	Researcher, Inst. of Applied Acoustics	RUS	Scientific expert, Technopark Skolkovo	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	Customer Consultant, Elsevier	BRA	BRA
2010.1.25 - 2011.3.31	Postdoc, Univ. of Alabama	USA	Research Associate, Clausthal Univ. of Technology	DEU	Senior Lecturer in Chemical Engineering, Brunel University 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 Institute (SERI),Universiti Kebangsaan Malaysia (UKM)	MYS	BGD
2010.3.24 - 2011.4.12	Postdoctoral Staff Researcher, Toyota Technical Center, Materials Research Department	USA	Researcher, North Carolina State Univ.	USA	Technical Sales Representative, Thermo Fisher Scientific	USA	USA
2010.4.1 - 2011.2.15	Project Researcher, Graduate School of Medicine, The Univ. of	JPN	Technical Staff, Okinawa Inst. of Science & Technology	JPN	Technical Sales Consultant-VIC, SA and TAS, Miltenyi Biotec, Melbourne, Victoria, Australia	AUS	IRN
2010.4.1 - 2011.2.28	Research Assistant, Max-Planck Inst. For Solid State Research	DEU	Postdoc, RIKEN	JPN	Senior 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	Assistant Professor, Technical Institute of Physics and Chemistry, 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	Research and development engineer, ALPhANOV	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 and Research Associate, National Univ. of Science and Technology (MISIS)	RUS	Research Associate, National University of Science and Technology MISIS, Moscow, Russia	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, Department of Biomedical Engineering, Sun Yat-Sen University (SYSU)	CHN	CHN
2012.1.1 - 2014.7.31	Researcher, Micro System Integration Center, Tohoku Univ.	JPN	Researcher, MEMS CORE Co., Ltd.	JPN	Associate Professor, National Chung Hsing University	TWN	TWN
2012.2.1 - 2012.3.31	Researcher, UCL	GBR	Research Associate, UCL	GBR	Assistant Professor, Advanced Materials, University 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	Assistant Professor, North Dakota State University	USA	IND

2012.5.1 - 2013.3.31	Researcher, Pusan Nationl Univ.	KOR	Researcher, Inst. of Multidisciplinary Research for Advanced Materials, Tohoku Univ.	JPN	Senior Researcher, Lam Reseach	KOR	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	Technical Manager, Ningbo Fwmaterials Co. Ltd	CHN	CHN
2012.9.16 - 2016.3.31	PhD. Student, Pisa Univ.	ITA	Researcher, Kyushu Univ.	JPN	Specially appointed assistant professor, 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.	FIN	ITA
2012.11.3 - 2013.11.2	Researcher, Univ. of Cambridge	GRB	Research Associate, Univ. of Cambridge	GBR	Professor, J. E. Purkyne University in Usti nad Labem, Czech Republic	CZE	CZE
2012.12.1 - 2014.9.15	Ph.D. Student, Technische Universität Berlin	DEU	Chemist, BASF-the Chemical Company	DEU	Hazardous Waste Manager at BASF SE, Germany	DEU	FRA
2012.12.1 - 2013.11.30	Researcher, Nanoco Technologies Ltd.	GBR	Research Associate, Univ. of Cambridge	GBR	Managing Consultant, ERM, UK	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	Researcher, Department of Physics, Technical University Munich, German	DEU	CHN
2013.7.26 - 2014.7.25	Ph.D. Student, Aix-Marseille Univ.	FRA	Postdoc, Unité Mixte de Physique, CNRS/Thales	FRA	Research Engineer, acting as internal auditor, CEA	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	Senior Research Fellow, Curtin Univ., Aus	AUS	GBR

2013.11.1 - 2014.7.31	Ph.D. Student, Univ. of Zurich	CHE	Research Scientist, Philochem AG	CHE	Program Leader at Philip Morris International, Swiss	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	Associate Professor, Institute for Advanced Materials Research and Development, Shimane University	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	Assistant Professor, C-Pair, Graduate School of Engineering Science, Osaka University	JPN	VNM
2015.4.1 - 2016.2.29	Posdoc, Universite Lille Nord de France, CNRS	FRA	Assistant Professor, Changchun Inst. of Applied Chemistry,	CHN	Researcher, 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, Spanish Council for Scientific Research (CSIC)	ESP	Research Professor, Institute for Bioengineering of Catalonia	ESP	ESP
2008.5.1 - 2015.9.25	Research Scientist, Honey Well Company	USA	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			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	Senior Process Development Scientist, APC	IRL	IND
2016.4.1 - 2017.1.31	Ph.D. Student, Comenius Univ.	SVK	Postdoc, Toyota Technological Inst.	JPN	Scientist Superconducting Magnet Technology, Bruker BioSpin	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	Process Engineer, FHR Anlagenbau GmbH	DEU	IRN
2015.10.1 - 2017.3.31	Researcher, Yamaguchi Univ.	JPN	Postdoc, Univ. of Toronto	CAN	Senior Muscle Scientist, Myo Palate	CAN	IRN
2015.10.1 - 2017.3.31	Research Associate, Jilin Univ.	CHN	Researcher, WPI-AIMR, Tohoku Univ.	JPN	Professor, Department of Metallic Materials Engineering, 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	Master Supervisor, Energy Research Institue, Jiangsu University	CHN	CHN
2015.5.1 - 2017.3.31	Postdoc, Aristotle Univ. of Thessaloniki	GRE	Senior Researcher, Central European Inst. of Technology (CEITEC)	CZE	Special Teaching Staff, Cyprus University Of Technology	CYP	CYP
2015.4.1 - 2017.3.31	Ph.D. Student, Univ. Bremen	DEU	Postdoc, Univ. of Alberta	CAN	Account Manager, imec	BEL	IRN
2011.11.1 - 2017.3.31	Senior Researcher, Moscow State Inst. of Steel and Alloys	RUS	Senior Research Associate, the Austrian Academy of Sciences	AUT	Senior PostDoc, 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	Associate Professor, Bennett Uni. (The Times Group)	IND	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	Data Consultant, Polyconseil	FRA	FRA
2017.4.1 - 2018.3.31	Postdoc., Ruder Boskovic Inst.	CRO	Research Associate, Rudjer Boskovic Inst.	CRO	Senior Research Associate, Rudjer Boskovic Institute	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	Associate Professor, Shanghai University	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	assistant professor, Graduate School of Human Development and Environment, Kobe University	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	DEU	Senior Engineer, Pharmaplan (TTP Group), Swiss	CHE	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	Associate Director, Asymchem Group	CHN	CHN
2017.8.1 - 2019.10.3	Postdoc, National Dong Hwa University	TWN	Research Fellow, Univ. of Southampton	GBR	Lecturer, Marie-Curie Fellow - University 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 Institute for Interdisciplinary Sciences, Tohoku University	JPN	CHN

2014.4.1 - 2023.3.31	Ph.D. Student, Graduate School of Science, Tohoku Univ.	JPN	Assistant Professor, WPI-AIMR, Tohoku Univ.	JPN	Postdoc, Department of Physics and Astronomy, Aarhus Univ.	DNK	VNM
2015.04.01 - 2020.7.31	Researcher, Universidad de Zaragoza	ESP	Postdoc Researcher, University of Santiago de Compostela	ESP	Ramón y Cajal Fellow, University of Santiago de Compostela	ESP	ESP
2019.06.01 - 2021.1.31	Postdoctoral Fellow, Hong Kong Univ. of Science and Technology	HNG	Postdoctoral fellow, Purdue University	USA	Assistant Professor, AIMR, Tohoku University	JPN	CHN
2019.09.01 - 2021.1.31	Visiting Researcher, University of Manchester	GBR	none		Assistant Professor, Institute of Remote Sensing and Geographic Information System, Peking University	CHN	CHN
2021.01.01 - 2022.07.15	CSIR-Senior Research Fellow, CSIR-National Physical Laboratory	IND	CS Technical Support Engineer 2, ASML Yokkaichi Office	JPN	Technical Support Engineer II, ASML	JPN	IND
2019.05.01 - 2022.09.30	Assistant Professor, Tokyo Metropolitan Univ.	JPN	Chemical Engineer, SOLiTHOR	BEL	Reviewer, Frontiers	BEL	IND
2020.04.01 - 2022.12.31	Ph.D. Student, School of Engineering, Tohoku Univ.	JPN	none		Postdoc (Hunan Province Key Laboratory for Advanced Carbon Materials and Applied Technology), Hunan University	CHN	CHN
2017.04.01 - 2023.03.31	Assistant Professor, Okayama Univ.	JPN	none		Research assistant, Tokyo Electron Ltd.	JPN	VNM
2018.04.01 - 2023.03.31	JSPS Postdoctoral Fellowship for Foreign Researchers	JPN	Associate Professor, Nagoya Univ.	JPN	Associate Professor, Nagoya Univ. JPN	JPN	AUS
2021.04.01 - 2023.03.31	Researcher, AIMR, Tohoku Univ.	JPN	none		Visiting Scientist, AIMR, Tohoku Univ.	JPN	MEX
2017.04.01 - 2023.03.31	Assistant Professor, RIEC, Tohoku Univ.	JPN	Professor, Beijing Institute of Technology	CHN	Professor, Beijing Institute of Technology	CHN	CHN
2021.08.01 - 2022.3.31	Technical Assistant, AIMR, Tohoku Univ.	JPN	Researcher, ASHBi Institute for the Advanced Study of Human Biology, Kyoto University	JPN	Researcher, SISSA mathLab	ITA	IND
2017.10.01 - 2022.3.31	Ph.D. Student, Dalhousie University	CAN	Associate Professor, Hunan Univ.	CHN	Associate Professor, Hunan Univ.	CHN	CHN
2018.08.01 - 2022.3.31	Postdoctoral Researcher, NIMS	JPN	Specially Appointed Lecturer, Nagoya Univ.	JPN	Specially Appointed Associate Professor, Nagoya Univ.	JPN	CHN

2022.04.01 - 2023.04.30	Invited Assistant Professor, Universidad de Lisboa	PRT	Junior Researcner, Instituto de Telecomunicações	PRT	Junior Researcher, Fundação para a Ciência e a Tecnologia	PRT	PRT
2020.05.01 - 2023.05.20	Postdoctoral Researcher, NIMS	JPN	Manager, AGC Inc.	JPN	Manager, AGC Inc.	JPN	IND
2018.06.01 - 2023.05.31	Lecturer, Igor Sikorsky Kyiv Polytechnic Institute	UKR	Assistant Professor, Kobe Univ.	JPN	Assistant Professor, Kobe Univ.	JPN	UKR
2020.11.01 - 2023.07.31	Postdoctoral Researcher, Aalto Univ.	FIN	none				CHN
2022.08.01 - 2023.07.31	Postdoc, SLAC-Stanford Linear Accelerator Conter	USA	Assistant Professor, University of Sao Paulo	BRA	Assistant Professor, University of Sao Paulo	BRA	BRA
2021.08.01 - 2023.08.31	JSPS Postdoctoral Fellowship for Foreign Researchers	JPN	Assistant Professor, Gakushuin Univ.	JPN	Assistant Professor, Gakushuin Univ.	JPN	DEU
2022.05.01 - 2023.10.20	Staff Researcher, Samsung Advanced Institute of Technology	KOR	Staff Researcher, Samsung Advanced Institute of Technology	KOR	Staff Researcher, Samsung Advanced Institute of Technology	KOR	KOR
2023.03.01 - 2023.11.30	Assistant, CIC EnergiGUNE	ESP	Materials Chemistry Lecturer, Manchester Metropolitan University	GBR	Materials Chemistry Lecturer, Manchester Metropolitan University	GBR	GBR
2021.7.1 - 2024.03.31	Postdoctoral Researcher, AIST	JPN	Specially Appointed Assistant Professor, Future University Hakodate	JPN	Specially Appointed Assistant Professor, Future University Hakodate	JPN	VNM

Project Expenditures FY2023

(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	616,598	Operational subsidies to National University Corporations/Incorporated Administrative Agency	15,579	Center director 1														
	2,101	Funding by WPI Academy	10,660	Administrative direct 1														
	-	Government Subsidies except Funding from WPI Academy	125,956	Principal investigator 16	-	Principal investigator 0	-	0	-	0	-	0	-	0	-	0	-	0
	-	Donations	90,422	・Full-time／Japane 8	-	・Full-time／Japanese												
	-	Indirect funding	26,761	・Concurrent／Japa 6	-	・Concurrent／Japanese												
	-	Joint research projects	8,773	・Full-time／Overse 2	-	・Full-time／Overseas												
	-	Competitive funding	-	・Concurrent／Overseas	-	・Concurrent／Overseas												
	-	Others	277,102	Other researchers 37	2,101	Other researchers 1	-	0	-	0	-	0	-	0	-	0	-	0
			277,102	・Associate professor /Assistant professor 37	2,101	・Associate professor /Assistant professor 1												
			-	・Others	-	・Others												
			626	Postdocs 1	-	Postdocs												
			46,453	Research support staffs 24	-	Research support staffs		Research support staffs										
			140,222	Administrative staffs 25	-	Administrative staffs		Administrative staffs										
Subtotal	618,699		616,598	105	2,101	1	-	0	-	0	-	0	-	0	-	0	-	0
Project activities	296,366	Operational subsidies to National University Corporations/Incorporated Administrative Agency	12,400	Honorarium for invited PIs, e	5,100	Honorarium for invited PIs, etc.					-	Honorarium for invited PIs, etc.						
	21,668	Funding by WPI Academy	12,130	Costs for maintaining satellite	13,723	Costs for maintaining satellites					-	Costs for maintaining satellites						
	-	Government Subsidies except Funding from WPI Academy	-	Costs for start-up	-	Costs for start-up					-	Costs for start-up						
	-	Donations	2,530	Costs for fusion research	-	Costs for fusion research					-	Costs for fusion research						
	64,528	Indirect funding	-	Costs for Target Projects	-	Costs for Target Projects					-	Costs for Target Projects						
	-	Joint research projects	594	Costs to hold international sy	-	Costs to hold international symposia					1,324	Costs to hold international symposia						
	-	Competitive funding	63,108	Expenses for consumables	32	Expenses for consumables					1,451	Expenses for consumables						
	-	Others	8,677	Light, heating and water utili	-	Light, heating and water utility costs					58,904	Light, heating and water utility costs						
			196,927	Others	2,813	Others					2,849	Others						
Subtotal	382,562		296,366		21,668		-		-		64,528		-		-		-	
Travel	31,142	Operational subsidies to National University Corporations/Incorporated Administrative Agency	13,570	Domestic travel expenses	-	Domestic travel expenses						Domestic travel expenses						
	7,081	Funding by WPI Academy	14,713	Overseas travel expenses	868	Overseas travel expenses						Overseas travel expenses						
	-	Government Subsidies except Funding from WPI Academy	-	Travel expenses for GI3 Lab	1,815	Travel expenses for GI3 Lab Program					-	Travel expenses for GI3 Lab Program						
	-	Donations	-	Travel expenses for inviting g	4,398	Travel expenses for inviting guests					9,143	Travel expenses for inviting guests						
	9,143	Indirect funding	2,859	Personal transfer allowance	-	Personal transfer allowance					-	Personal transfer allowance						
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	47,366		31,142		7,081		-		-		9,143		-		-		-	
Equipment	28,412	Operational subsidies to National University Corporations/Incorporated Administrative Agency	28,412	Costs for facilities/equipment	-	Costs for facilities/equipment						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	28,412		28,412		-		-		-		-		-		-		-	
Research projects	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency							44,229				116,974		179,178	KAKENHI	16,836	Others
	-	Funding by WPI Academy													844,650	Consigned research funds (JST, others)		
	-	Government Subsidies except Funding from WPI Academy																
	44,229	Donations																
	-	Indirect funding																
	116,974	Joint research projects																
	1,023,828	Competitive funding																
	16,836	Others																
Subtotal	1,201,867		-		-		-		44,229		-		116,974		1,023,828		16,836	
Others	328,797	Operational subsidies to National University Corporations/Incorporated Administrative Agency	328,797	Depreciation costs														
	-	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	-	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	328,797		328,797		-		-		-		-		-		-		-	
Total	2,607,703		1,301,315		30,850		-		44,229		73,671		116,974		1,023,828		16,836	

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 FY2022

(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	542,344	Operational subsidies to National University Corporations/Incorporated Administrative Agency	15,654	Center director 1														
	9,441	Funding by WPI Academy	-	Administrative director			10,642	Administrative director 1										
	23,160	Government Subsidies except Funding from WPI Academy	115,613	Principal investigator 16	-	Principal investigator 0	-	0	-	0	-	0	-	0	-	0	-	0
	-	Donations	79,413	・Full-time／Japane 7	-	・Full-time／Japanese												
	247	Indirect funding	27,499	・Concurrent／Japa 7	-	・Concurrent／Japanese												
	-	Joint research projects	8,701	・Full-time／Overse 2	-	・Full-time／Overseas												
	-	Competitive funding	-	・Concurrent／Overseas	-	・Concurrent／Overseas												
	-	Others	250,667	Other researchers 40	9,441	Other researchers 1	-	0	-	0	-	0	-	0	-	0	-	0
			250,667	・Associate professor /Assistant professor 40	9,441	・Associate professor /Assistant professor 1												
			-	・Others	-	・Others												
			1,293	Postdocs 1	-	Postdocs												
			45,600	Research support staffs 31	-	Research support staffs	-	Research support staffs			247	Research support staffs 0						
			113,517	Administrative staffs 20	-	Administrative staffs	12,518	Administrative staffs 3										
Subtotal	575,192		542,344	109	9,441	2	23,160	4	-	0	247	0	-	0	-	0	-	0
Project activities	205,858	Operational subsidies to National University Corporations/Incorporated Administrative Agency	2,700	Honorarium for invited PIs, e	10,000	Honorarium for invited PIs, etc	-	Honorarium for invited PIs, etc.			-	Honorarium for invited PIs, etc.						
	29,048	Funding by WPI Academy	-	Costs for maintaining satellite	4,392	Costs for maintaining satellites	-	Costs for maintaining satellites			-	Costs for maintaining satellites						
	2,140	Government Subsidies except Funding from WPI Academy	-	Costs for start-up	-	Costs for start-up	-	Costs for start-up			-	Costs for start-up						
	-	Donations	4,000	Costs for fusion research	-	Costs for fusion research	-	Costs for fusion research			-	Costs for fusion research						
	72,563	Indirect funding	-	Costs for Target Projects	-	Costs for Target Projects	-	Costs for Target Projects			-	Costs for Target Projects						
	-	Joint research projects	-	Costs to hold international sy	-	Costs to hold international sym	-	Costs to hold international symposia			-	Costs to hold international symposia						
	-	Competitive funding	56,050	Expenses for consumables	618	Expenses for consumables	-	Expenses for consumables			4,979	Expenses for consumables						
	-	Others	20,191	Light, heating and water utili	-	Light, heating and water utility	-	Light, heating and water utility costs			56,077	Light, heating and water utility costs						
			122,917	Others	14,038	Others	2,140	Others			11,507	Others						
Subtotal	309,609		205,858		29,048		2,140		-		72,563		-		-		-	
Travel	19,480	Operational subsidies to National University Corporations/Incorporated Administrative Agency	10,476	Domestic travel expenses	-	Domestic travel expenses	-	Domestic travel expenses				Domestic travel expenses						
	805	Funding by WPI Academy	2,802	Overseas travel expenses	401	Overseas travel expenses	-	Overseas travel expenses				Overseas travel expenses						
	-	Government Subsidies except Funding from WPI Academy	-	Travel expenses for GI3 Lab	-	Travel expenses for GI3 Lab Pr	-	Travel expenses for GI3 Lab Program				Travel expenses for GI3 Lab Program						
	-	Donations	-	Travel expenses for inviting g	404	Travel expenses for inviting gu	-	Travel expenses for inviting guests				Travel expenses for inviting guests						
	-	Indirect funding	6,202	Personal transfer allowance	-	Personal transfer allowance	-	Personal transfer allowance				Personal transfer allowance						
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	20,285		19,480		805		-		-		-		-		-		-	
Equipment	20,680	Operational subsidies to National University Corporations/Incorporated Administrative Agency	20,680	Costs for facilities/equipment							1,225	Costs for facilities/equipment						
	-	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	1,225	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	21,905		20,680		-		-		-		1,225		-		-		-	
Research projects	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency							43,450				69,661		204,281	KAKENHI	21,623	Others
	-	Funding by WPI Academy													366,372	Consigned research funds (JST, others)		
	-	Government Subsidies except Funding from WPI Academy																
	43,450	Donations																
	-	Indirect funding																
	69,661	Joint research projects																
	570,653	Competitive funding																
	21,623	Others																
Subtotal	705,387		-		-		-		43,450		-		69,661		570,653		21,623	
Others	187,754	Operational subsidies to National University Corporations/Incorporated Administrative Agency	187,754	Depreciation costs														
	-	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	-	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	187,754		187,754		-		-		-		-		-		-		-	
Total	1,820,132		976,116		39,294		25,300		43,450		74,035		69,661		570,653		21,623	

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 FY2021

(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	510,682	Operational subsidies to National University Corporations/Incorporated Administrative Agency	15,801	Center director 1														
	13,765	Funding by WPI Academy	-	Administrative director			10,606	Administrative director 1										
	28,518	Government Subsidies except Funding from WPI Academy	135,451	Principal investigator 17	-	Principal investigator 0	-	0	-	0	-	0	-	0	-	0	-	0
	-	Donations	92,660	・Full-time／Japane 8	-	・Full-time／Japanese												
	442	Indirect funding	33,067	・Concurrent／Japa 7	-	・Concurrent／Japanese												
	-	Joint research projects	9,724	・Full-time／Overse 2	-	・Full-time／Overseas												
	-	Competitive funding	-	・Concurrent／Overseas	-	・Concurrent／Overseas												
	-	Others	216,197	Other researchers 41	10,292	Other researchers 1	-	0	-	0	-	0	-	0	-	0	-	0
			216,197	・Associate professor /Assistant professor 41	10,292	・Associate professor /Assistant professor 1												
			-	・Others	-	・Others												
			4,375	Postdocs 2	-	Postdocs												
			42,085	Research support staffs 22	-	Research support staffs	-	Research support staffs			442	Research support staffs 0						
			96,773	Administrative staffs 18	3,473	Administrative staffs 1	17,912	Administrative staffs 5				Administrative staffs						
Subtotal	553,407		510,682	101	13,765	2	28,518	6	-	0	442	0	-	0	-	0	-	0
Project activities	235,048	Operational subsidies to National University Corporations/Incorporated Administrative Agency	-	Honorarium for invited PIs, e	9,200	Honorarium for invited PIs, etc	-	Honorarium for invited PIs, etc.			-	Honorarium for invited PIs, etc.						
	27,820	Funding by WPI Academy	-	Costs for maintaining satellite	5,740	Costs for maintaining satellites	-	Costs for maintaining satellites			-	Costs for maintaining satellites						
	2,482	Government Subsidies except Funding from WPI Academy	-	Costs for start-up	-	Costs for start-up	1,997	Costs for start-up			-	Costs for start-up						
	-	Donations	3,454	Costs for fusion research	-	Costs for fusion research	-	Costs for fusion research			-	Costs for fusion research						
	85,847	Indirect funding	18,146	Costs for Target Projects	-	Costs for Target Projects	-	Costs for Target Projects			-	Costs for Target Projects						
	-	Joint research projects	336	Costs to hold international sy	-	Costs to hold international sym	-	Costs to hold international symposia			-	Costs to hold international symposia						
	-	Competitive funding	57,907	Expenses for consumables	4,357	Expenses for consumables	-	Expenses for consumables			897	Expenses for consumables						
	-	Others	-	Light, heating and water utili	-	Light, heating and water utility	-	Light, heating and water utility costs			54,301	Light, heating and water utility costs						
			155,205	Others	8,523	Others	485	Others			30,649	Others						
Subtotal	351,197		235,048		27,820		2,482		-		85,847		-		-		-	
Travel	4,135	Operational subsidies to National University Corporations/Incorporated Administrative Agency	3,579	Domestic travel expenses	-	Domestic travel expenses	-	Domestic travel expenses			-	Domestic travel expenses						
	-	Funding by WPI Academy	114	Overseas travel expenses	-	Overseas travel expenses	-	Overseas travel expenses			-	Overseas travel expenses						
	-	Government Subsidies except Funding from WPI Academy	-	Travel expenses for GI3 Lab	-	Travel expenses for GI3 Lab Pr	-	Travel expenses for GI3 Lab Program										
	-	Donations	-	Travel expenses for inviting g	-	Travel expenses for inviting gu	-	Travel expenses for inviting guests										
	-	Indirect funding	442	Personal transfer allowance	-	Personal transfer allowance	-	Personal transfer allowance										
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	4,135		4,135		-		-		-		-		-		-		-	
Equipment	27,718	Operational subsidies to National University Corporations/Incorporated Administrative Agency	27,718	Costs for facilities/equipment	8,415	Costs for facilities/equipment	-				1,316							
	8,415	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	1,316	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	37,449		27,718		8,415		-		-		1,316		-		-		-	
Research projects	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency							37,859				33,943		295,330	KAKENHI	21,371	Others
	-	Funding by WPI Academy													414,998	Consigned research funds (JST, others)		
	-	Government Subsidies except Funding from WPI Academy																
	37,859	Donations																
	-	Indirect funding																
	33,943	Joint research projects																
	710,328	Competitive funding																
	21,371	Others																
Subtotal	803,501		-		-		-		37,859		-		33,943		710,328		21,371	
Others	128,819	Operational subsidies to National University Corporations/Incorporated Administrative Agency	128,819	Depreciation costs														
	-	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	-	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	128,819		128,819		-		-		-		-		-		-		-	
Total	1,878,508		906,402		50,000		31,000		37,859		87,605		33,943		710,328		21,371	

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 FY2020

(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	494,667	Operational subsidies to National University Corporations/Incorporated Administrative Agency	15,713	Center director 1														
	12,781	Funding by WPI Academy	-	Administrative director			10,544	Administrative direct 1										
	27,946	Government Subsidies except Funding from WPI Academy	136,269	Principal investigator 15	-	Principal investigator 0	-	0	-	0	-	0	-	0	-	0	-	0
	-	Donations	107,329	・Full-time／Japane 9	-	・Full-time／Japanese												
	2,575	Indirect funding	14,765	・Concurrent／Japa 4	-	・Concurrent／Japanese												
	-	Joint research projects	14,175	・Full-time／Overse 2	-	・Full-time／Overseas												
	-	Competitive funding	-	・Concurrent／Overseas	-	・Concurrent／Overseas												
	-	Others	198,690	Other researchers 46	10,463	Other researchers 1	-	0	-	0	-	0	-	0	-	0	-	0
			198,690	・Associate professor /Assistant professor 46	10,463	・Associate professor /Assistant professor 1												
			-	・Others	-	・Others												
			6,166	Postdocs 2	-	Postdocs												
			44,356	Research support staffs 16	-	Research support staffs	9,823	Research support staffs 3			1,739	Research support staffs 0						
			93,473	Administrative staffs 17	2,318	Administrative staffs 1	7,579	Administrative staffs 2			836	Administrative staffs 1						
Subtotal	537,969		494,667	97	12,781	2	27,946	6	-	0	2,575	1	-	0	-	0	-	0
Project activities	155,743	Operational subsidies to National University Corporations/Incorporated Administrative Agency	6,600	Honorarium for invited PIs, e	-	Honorarium for invited PIs, etc	93	Honorarium for invited PIs, etc.			2,600	Honorarium for invited PIs, etc.						
	22,774	Funding by WPI Academy	-	Costs for maintaining satellit	7,614	Costs for maintaining satellites	-	Costs for maintaining satellites			-	Costs for maintaining satellites						
	7,054	Government Subsidies except Funding from WPI Academy	-	Costs for start-up	-	Costs for start-up	-	Costs for start-up			-	Costs for start-up						
	-	Donations	15,926	Costs for fusion research	-	Costs for fusion research	-	Costs for fusion research			-	Costs for fusion research						
	72,544	Indirect funding	15,029	Costs for Target Projects	-	Costs for Target Projects	-	Costs for Target Projects			-	Costs for Target Projects						
	-	Joint research projects	1,579	Costs to hold international sy	-	Costs to hold international sym	-	Costs to hold international symposia			-	Costs to hold international symposia						
	-	Competitive funding	45,055	Expenses for consumables	3,613	Expenses for consumables	1,313	Expenses for consumables			1,404	Expenses for consumables						
	-	Others	-	Light, heating and water utili	-	Light, heating and water utility	-	Light, heating and water utility costs			47,613	Light, heating and water utility costs						
			71,554	Others	11,547	Others	5,648	Others			20,927	Others						
Subtotal	258,115		155,743		22,774		7,054		-		72,544		-		-		-	
Travel	3,902	Operational subsidies to National University Corporations/Incorporated Administrative Agency	1,967	Domestic travel expenses	40	Domestic travel expenses												
	40	Funding by WPI Academy	107	Overseas travel expenses	-	Overseas travel expenses												
	-	Government Subsidies except Funding from WPI Academy	-	Travel expenses for GI3 Lab	-	Travel expenses for GI3 Lab Program												
	-	Donations	-	Travel expenses for inviting g	-	Travel expenses for inviting guests												
	-	Indirect funding	1,828	Personal transfer allowance	-	Personal transfer allowance												
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	3,942		3,902		40		-		-		-		-		-		-	
Equipment	32,663	Operational subsidies to National University Corporations/Incorporated Administrative Agency	32,663	Costs for facilities/equipment	16,225	Costs for facilities/equipment												
	16,225	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	-	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	48,888		32,663		16,225		-		-		-		-		-		-	
Research projects	-	Operational subsidies to National University Corporations/Incorporated Administrative Agency							22,980				40,134		182,338	KAKENHI	78,788	Others
	-	Funding by WPI Academy													438,876	Consigned research funds (JST, others)		
	-	Government Subsidies except Funding from WPI Academy																
	22,980	Donations																
	-	Indirect funding																
	40,134	Joint research projects																
	621,214	Competitive funding																
	78,788	Others																
Subtotal	763,116		-		-		-		22,980		-		40,134		621,214		78,788	
Others	259,382	Operational subsidies to National University Corporations/Incorporated Administrative Agency	259,382	Depreciation costs														
	-	Funding by WPI Academy																
	-	Government Subsidies except Funding from WPI Academy																
	-	Donations																
	-	Indirect funding																
	-	Joint research projects																
	-	Competitive funding																
	-	Others																
Subtotal	259,382		259,382		-		-		-		-		-		-		-	
Total	1,871,412		946,357		51,820		35,000		22,980		75,119		40,134		621,214		78,788	

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 2020 and 2023 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.

Case 1: Initiative to Increase the Number of English Press Releases

(Overview) In order to increase the number of English press releases, which have significantly. more journalists compared to Japanese press releases, we raised awareness through activities like Friday Tea Time and strongly encouraged applicants for Japanese press releases to issue English press releases. As a result, the number of English press releases in 2023 nearly tripled from 9 in 2022 to 27, contributing to the increase in visibility of AIMR and the WPI programs.

Case 2: Internalization and Renewal of "AIMResearch"

(Overview) "AIMResearch," a research results PR magazine that had been outsourced to an external company (Nature Japan) and published once a month until FY2020, was internalized from FY2021, reducing costs by one-third. From FY2023, the number of monthly publications of "Research Highlights", an important content that introduces notable papers, was increased by 1.5 times, and the selection method for articles was changed from the traditional self-recommendation or other recommendation to selecting articles from the top 10% rank, with final decisions made by the director. The proportion of mathematics-related articles was increased from 10% to 30%, and "AIMResearch" was renewed as an online content only. Despite significant cost reductions, the English version of "AIMResearch," which handles overseas PR, maintained its page views, increasing researchers' willingness to write papers and press releases, leading to the enhancement of the visibility of AIMR.

Case 3: Press Releases via Online Press Conferences

(Overview) Simultaneously with press release distribution, an online press conference was held, resulting in inquiries from a local TV station and newspapers. Furthermore, three articles were reported in print newspapers such as the Nikkei, and 16 articles were featured online, including on Yahoo News. This contributed to the increased visibility of AIMR and the WPI program.

Appendix 4a State of Outreach Activities from FY 2020 to FY 2023

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

Activities	FY 2020 (number of activities, times held)	FY 2021 (number of activities, times held)	FY 2022 (number of activities, times held)	FY 2023 (number of activities, times held)
PR brochure, pamphlet	1	2	1	1
Lectures, seminars for general public	0	0	0	0
Teaching, experiments, training for elementary, secondary and high school students	1	1	1	2
Science café	0	0	0	0
Open house	0	1	0	1
Participating, exhibiting in events	1	2	3	2
Press releases	23 (J15, E8)	37 (J28, E9)	26 (J17, E9)	54 (J27, E27)
Publications of popular science books	0	0	0	0
Others (Media Coverage)	0	0	2 [A]	2 [B]

*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>

[A] 1. Overseas TV (BBC), 2. Domestic Publisher (Kodansha)

[B] 1. Domestic TV (NTV), 2. Domestic Local TV (MMT)

WPI Academy
List of Center's Research Results

Refereed Papers published in the period from 2020 to 2023

Order of Listing

A. WPI papers

Papers whose author(s) can be identified as affiliated with the WPI program (e.g., that state "WPI" and the name of the WPI center (WPI-center name)). (Not including papers in which the names of persons affiliated with the WPI program are contained only in the acknowledgements.)

B. WPI-related papers

Papers related to the WPI Academy center but whose authors are not noted in the institutional affiliations as WPI affiliated. (Including papers whose acknowledgements contain the names of researchers affiliated with the WPI program.)

Notes

The list should be for the calendar year, not the fiscal year.

A. WPI papers

1) Abe, Hiroya; Nozaki, Kohei; Sokabe, Shu; Kumatani, Akichika; Matsue, Tomokazu; Yabu, Hiroshi, S/N Co-Doped Hollow Carbon Particles for Oxygen Reduction Electrocatalysts Prepared by Spontaneous Polymerization at Oil-Water Interfaces. ACS Omega **5**, 18391-18396 (2020). DOI: 10.1021/acsomega.0c02182
2) Abe, Hiroya; Yabu, Hiroshi; Kunikata, Ryota; Suda, Atsushi; Matsudaira, Masahki; Matsue, Tomokazu, Redox cycling-based electrochemical CMOS imaging sensor for real time and selective imaging of redox analytes. Sens. Actuator B-Chem. **304**, 127245 (2020). DOI: 10.1016/j.snb.2019.127245
3) Abe, Hiroyuki; Kimura, Yasuo; Ma, Teng; Tadaki, Daisuke; Hirano-Iwata, Ayumi; Niwano, Michio, Response characteristics of a highly sensitive gas sensor using a titanium oxide nanotube film decorated with platinum nanoparticles. Sens. Actuator B-Chem. **321**, 128525 (2020). DOI: 10.1016/j.snb.2020.128525
4) Amrillah, Tahta; Chen, Yu-Xun; My Ngoc Duong; Abdussalam, Wildan; Simanjuntak, Firman Mangasa; Chen, Chia-Hao; Chu, Ying-Hao; Juang, Jenh-Yih, Effects of pillar size modulation on the magneto-structural coupling in self-assembled $BiFeO_3$-$CoFe_2O_4$ heteroepitaxy. Crystengcomm **22**, 435-440 (2020). DOI: 10.1039/c9ce01573f
5) An, K.; Litvinenko, A. N.; Kohno, R.; Fuad, A. A.; Naletov, V. V.; Vila, L.; Ebels, U.; de Loubens, G.; Hurdequint, H.; Beaulieu, N.; Ben Youssef, J.; Vukadinovic, N.; Bauer, G. E. W.; Slavin, A. N.; Tiberkevich, V. S.; Klein, O., Coherent long-range transfer of angular momentum between magnon Kittel modes by phonons. Phys. Rev. B **101**, 60407 (2020). DOI: 10.1103/PhysRevB.101.060407
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7) Avalos, Edgar; Xie, Shuangquan; Akagi, Kazuto; Nishiura, Yasumasa, Bridging a mesoscopic inhomogeneity to macroscopic performance of amorphous materials in the framework of the phase field modeling. Physica D **409**, 132470 (2020). DOI: 10.1016/j.physd.2020.132470
8) Baldrati, L.; Schmitt, C.; Gomonay, O.; Lebrun, R.; Ramos, R.; Saitoh, E.; Sinova, J.; Klaeui, M., Efficient Spin Torques in Antiferromagnetic CoO/Pt Quantified by Comparing Field- and Current-Induced Switching. Phys. Rev. Lett. **125**, 77201 (2020). DOI: 10.1103/PhysRevLett.125.077201
9) Bazlov, A., I; Parhomenko, M. S.; Mamzurina, O., I; Karpenkov, D. Yu; Serhiienko, I; Prosviryakov, A. S.; Zanaeva, E. N.; Louzguine-Luzgin, D., V, Effect of manganese addition on thermal and electrical properties of

$Zr_{45}Cu_{45}Al_{10}$ metallic glass. J. Non-Cryst. Solids **542**, 120103 (2020). DOI: 10.1016/j.jnoncrysol.2020.120103
10) Belosludov, R. V.; Oreshkin, A. I.; Oreshkin, S. I.; Muzychenko, D. A.; Kato, H.; Louzguine-Luzgin, D. V., The atomic structure of a bulk metallic glass resolved by scanning tunneling microscopy and ab-initio molecular dynamics simulation. J. Alloy. Compd. **816**, 152680 (2020). DOI: 10.1016/j.jallcom.2019.152680
11) Bertelli, Iacopo; Carmiggelt, Joris J.; Yu, Tao; Simon, Brecht G.; Pothoven, Coosje C.; Bauer, Gerrit E. W.; Blanter, Yaroslav M.; Aarts, Jan; van der Sar, Toeno, Magnetic resonance imaging of spin-wave transport and interference in a magnetic insulator. Sci. Adv. **6**, eabd3556 (2020). DOI: 10.1126/sciadv.abd3556
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13) Bourne, Chris; Kellendonk, Johannes; Rennie, Adam, The Cayley transform in complex, real and graded K-theory. Int. J. Math. **31**, 2050074 (2020). DOI: 10.1142/S0129167X20500743
14) Cao, Thuy T.; Yabu, Hiroshi; Huh, Do S., Hierarchical Nano/Micro Moth Eyelike Polymer Film Using Solid/Liquid Interfacial Reaction at Room Temperature. Langmuir **36**, 9064-9073 (2020). DOI: 10.1021/acs.langmuir.0c00894
15) Chai, Yu; Hasnain, Jaffar; Bahl, Kushaan; Wong, Matthew; Li, Dong; Geissler, Phillip; Kim, Paul Y.; Jiang, Yufeng; Gu, Peiyang; Li, Siqi; Lei, Dangyuan; Helms, Brett A.; Russell, Thomas P.; Ashby, Paul D., Direct observation of nanoparticle-surfactant assembly and jamming at the water-oil interface. Sci. Adv. **6**, abb8675 (2020). DOI: 10.1126/sciadv.abb8675
16) Chen, Bihai; Wada, Takehiko; Yabu, Hiroshi, Underwater Bubble and Oil Repellency of Biomimetic Pincushion and Plastron-Like Honeycomb Films. Langmuir **36**, 6365-6369 (2020). DOI: 10.1021/acs.langmuir.0c00427
17) Chen, Hua-Hsuan; Toko, Susumu; Ohori, Daisuke; Ozaki, Takuya; Utsuno, Mitsuya; Kubota, Tomohiro; Nozawa, Toshihisa; Samukawa, Seiji, Growing low-temperature, high-quality silicon-dioxide films by neutral-beam enhanced atomic-layer deposition. J. Phys. D-Appl. Phys. **53**, 15204 (2020). DOI: 10.1088/1361-6463/ab484d
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19) Chen, Tong; Gu, Qinyan; Chen, Qun; Wang, Xiaomeng; Pickard, Chris J.; Needs, Richard J.; Xing, Dingyu; Sun, Jian, Prediction of quasi-one-dimensional superconductivity in metastable two-dimensional boron. Phys. Rev. B **101**, 54518 (2020). DOI: 10.1103/PhysRevB.101.054518
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B. WPI-related papers

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