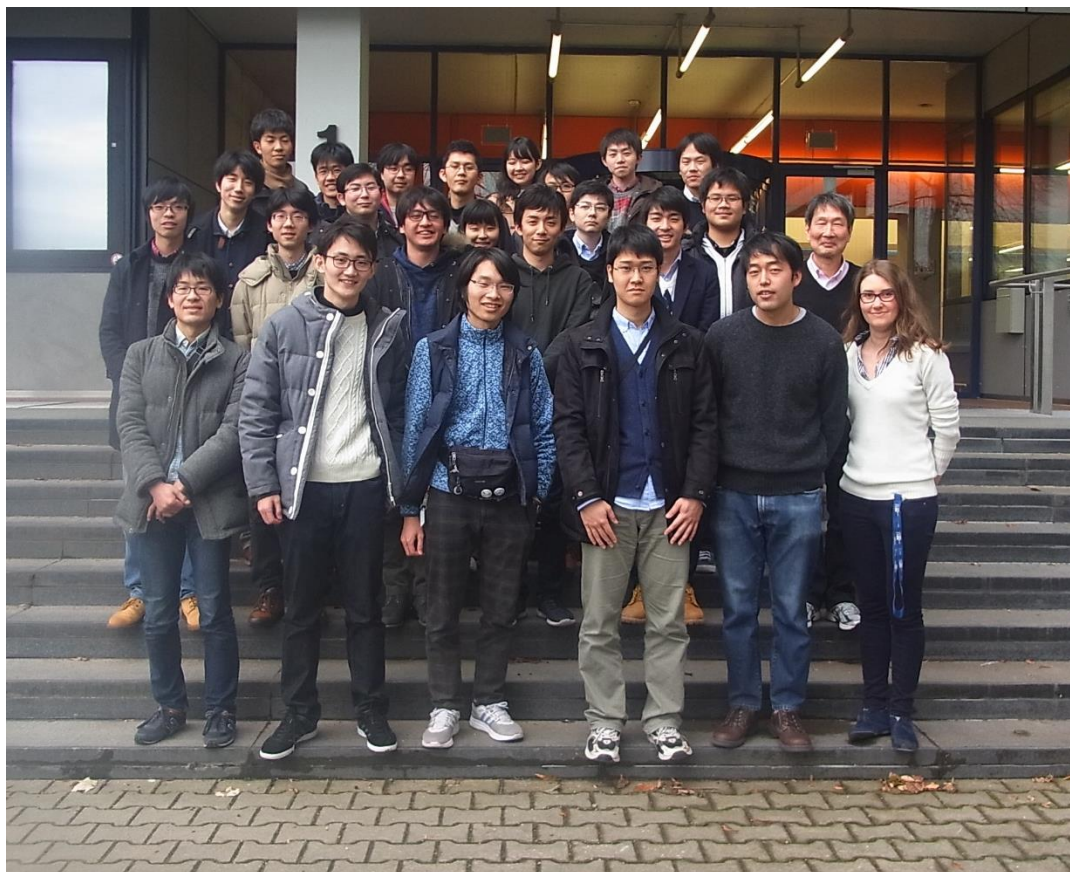


Report of the 5th MERIT overseas training



February 27 – March 5, 2017
MAX-PLANCK-INSTITUTE, STUTTGART



東京大学

統合物質科学リーダー養成プログラム

Materials Education program for the future leaders in Research, Industry, and Technology

Contents

Preface 3

Schedule 5

Participants & Personal Reports

Graduate School of Engineering p. 6~
Department of Applied Physics

Miuko Tanaka
Ryutaro Nishino
Yukako Fujishiro
Akishi Matsugatani

Department of Electrical Engineering and
Information Systems

Yusuke Hata

Department of Chemical System
Engineering

Naoya Fujiwara

Department of Chemistry and
Biotechnology

Akihiro Eguchi

Graduate School of Science p. 21~
Department of Physics

So Kunisada
Ikuma Tateishi
Tomoki Hirosawa
Yongtae Hwang
Kiyu Fukui
Zhendong Chi
Yamato Komatsu
Ryosuke Sekine
Hiroki Hanayama

Department of Chemistry

Graduate School of Frontier Sciences p. 42~

Department of Advanced Materials Science

Yusuke Yasuda
Yusuke Araki
Kousuke Ishida
Tsuyoshi Omi
Ryo Fujimoto
Tatsuyuki Makita

Faculties

Department of Physics

Professor Hidenori Takagi

Department of Applied Physics

Project Lecturer Masaki Nakano

Preface

This overseas training was held for 7 days from February 27 to March 5 in 2017 as a part of course programs of “Materials Education program for the future leaders in Research, Industry and Technology (MERIT)” at the University of Tokyo. 22 master students who decided to go on to a doctoral course were selected from 7 departments, “Department of Applied Physics”, “Department of Electrical Engineering and Information Systems”, “Department of Chemical System Engineering”, and “Department of Chemistry and Biotechnology” from Graduate School of Engineering, “Department of Physics” and “Department of Chemistry” from Graduate School of Science, and “Department of Advanced Materials Science” from Graduate School of Frontier Sciences. They all visited to Max-Planck -Institute in Stuttgart (MPI) for one day, and separately visited to universities and research institutes near MPI for three days as free activities.

On February 28, all the students visited to MPI. Representatives of each department in MPI introduced their research activities to the students, and guided them to lab tour afterward. In the afternoon, there was a quick campus tour planned by the student in MPI. After that, the concept and practical activities of MERIT program was introduced to the researchers in MPI, followed by free discussions on similarities and differences in education programs and research environment between Germany and Japan. Then, the poster session between the MERIT students and the researchers in MPI was held, as the first attempt of the workshop in MERIT overseas training.

From March 1 to 3, the students had three free days, and visited to universities and research institutes in different places according to their schedules fixed by themselves prior to the visit. Some students crossed the borders to enter Switzerland and France, and experienced research life in Europe to broaden their scope. Details are described in the individual report

from each student attached at the end of this report.

Finally, we sincerely appreciate all the faculties including Professor Toshihiko Koseki, who is the program director, Professor Masashi Kawasaki, who is the program coordinator, Professor Masakazu Ichikawa, who is the program chief manager and Professor Hidenori Takagi and Project Lecturer Masaki Nakano, who are the leaders of this overseas training. Also we want to thank all the staffs in MPI and those who took care of us during our free activities.

(From all the members joining this training in FY2016)

Schedule

February 27(Monday)

- 12:45 Departure from Haneda Airport
- 16:50 Arrival at Munich Airport
- 18:50 Departure from Munich Airport
- 19:35 Arrival at Stuttgart Airport, went to MPI guest house

February 28(Tuesday)

- | | |
|-------------|------------------------------------|
| 9:00~10:50 | Introduction of departments in MPI |
| 11:00~12:30 | Lab tour |
| 12:30~13:30 | Lunch |
| 13:30~14:30 | Campus tour |
| 15:00~15:50 | Introduction of UT and MERIT |
| 16:00~18:00 | Workshop (poster session) |
| 18:00~ | Free discussions |

March 1(Wednesday)~March 3(Friday)

Free Activities

March 4(Saturday)

- | | |
|-------|----------------------------------|
| 15:00 | Departure from Stuttgart Airport |
| 15:50 | Arrival at Frankfurt Airport |
| 17:50 | Departure from Frankfurt Airport |

March 5(Sunday)

- | | |
|-------|--|
| 13:05 | Arrival at Haneda Airport, and Breakup |
|-------|--|

MERIT overseas training report

School of engineering, Department of applied physics,
Master course 1st, Miuko Tanaka

【 March 1st Holleitner Lab. in Technische Universitat Munchen 】

On the first day, I visited Holleitner Lab in Schottky Institute which located in suburbs of Munchen. This laboratory deal with 2D topological insulator, graphene, and living molecule using ultrafast measurement system with pulsed laser and photoconductive switch. Ms. Sandra showed me clean room and optical system.

What I was most impressed is He ion microscope which can be also used as etching machine. Conventional Si photo conductive switch have time resolution of around few pico seconds. They are trying to obtain better resolution with new switch using nano size gap in Au electrode. He ion etching machine is used to make the nano size gap.

She also explained detail of optical measurement method, for example, how to get short pulse, how to distinguish coherent response and thermal response, and how to align the light to sample. It was very fruitful for me.

In addition, I had opportunity to discuss about the research of spin state read out of NV center using graphene, which I was most interested on.

【 March 2nd Bouchiat Lab. in Paris Sud Universite 】

Second day, I visited Paris Sud Universite in Orsay. Orsay is full of slope and green. I found a mountain in the campus.

Bouchiat Lab deal with nanowire, graphene, and TMD (transition metal dichalcogenide) using electric transport measurement. Measurement setup is very similar to Tarucha Lab. I belong to.

I received detailed explanation about two research. One is about edge channel of Bi nanowire and the other is about graphene / TMD hetero structure. I had much interest on the latter in which they induced spin-orbit interaction to graphene by encapsulating it with TMD, and proved the existence of induced SO interaction by anti weak localization. I discussed about that research with Dr. Wakamura.

I also had opportunity to present my research about spin-valley current of graphene. I got some fruitful feedback from them.

After the visit, Prof. Bouchiat was kind enough to invite me for dinner. We talked not only about physics, but also about education system in France, career pass of PhD students, and recommended beautiful place in Paris. I had a good time.

【 March 3rd Kontos Lab. in Ecole Normale Supérieure】

Third day, I visited Kontos Lab. in ENS near the jardin du Luxembourg. This Laboratory deal with interaction of quantum dots and micro wave cavity, cooper pair splitter with carbon nanotube quantum dots, study of Kondo effect using micro wave, and recently, interaction of quantum dots and THz wave.

I received explanation from PhD student about cooper pair splitter. This Lab. work actively with collaborative research. They showed me during start up THz measurement system which is one of the collaborative research.



I had a lunch with Prof. Kontos and his students, and I could glimpse the campus life of them. I was surprised about that they usually talk English even during lunch because there are many foreign students. I hear that ENS work actively with accepting foreign students and they can take enough support. It was good information which become useful when thinking about studying abroad.

【 summary 】

In this oversea program, I visited three laboratory and all of them were really kind. I had good opportunity to see experimental facilities, to discuss research issue, and to talk various things (campus life in Germany and France, etc.) with students. I had sense of resistance against studying abroad because I had never almost gone abroad.



However, through this program, I found that Lab. in Germany and France are not so much different from Lab. in Japan on a basis part, for example how to progress experiment or meeting, and relationship between students and teacher. This finding decreased my resistance very much. On the other hand, I keenly felt my disability of English.

Finally, I really appreciate Nakano-sensei and Takagi-sensei for support before and during the program, Tarucha-sensei for advice about visiting place, and especially people in MPI, Holleitner Lab., Bouchiat Lab., and Kontos Lab. for very kind support.

MERIT overseas training

Department of Applied physics, M1

Ryutaro Nishino

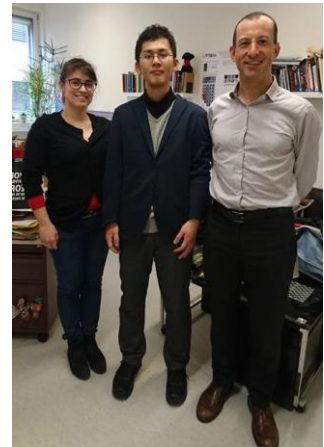
I visited to Prof. Mannhart Group at max planck institute, Prof. Triscone Group at Geneva university and CERN during free 3days.

• 1/3(Wed.) Visit to Prof. Mannhart Group

I visited to Prof. Mannhart Group at max planck institute. This group mainly focus on oxide thin film which is very related to our group research. The PLD chamber in this group is very surprising. PLD machines, an ion milling, an EB evaporation, a sputtering, and glove boxes are connected each other. They can do every process from thin film growth to device preparation without any contamination. The equipment of leading-edge laboratory is excellent.

• 2/3(Thu.) Visit to Prof. Triscone Group

Next day, I visited to Prof. Triscone Group at Geneva university. This group is researching on ferroelectric thin film which is related to my research. I saw a lot of equipment such as PFM, magnetron sputtering machine and so on. They are not seen in our group. I ate lunch with group member and presented my research at group meeting. The discussion with group member was very exciting because I am the only person researching on ferroelectrics in our group. I would like to work with them in the future.



• 3/3(Fri.) Visit to CERN

CERN is the institution having the biggest accelerator whose total length is over 27km. It can accelerate particles to 99.9999991% that of light. This plays an important role in particle research. Recently it contributed to discovery of Higgs particle. This institution is formed by many researchers and engineers. I was impressed by their significant endeavor and collaboration.

• Acknowledgments

Thank you very much for every people organizing this overseas training. I significantly appreciate people who accepted me. It was a precious opportunity for me.

Report on visiting ETH, Stuttgart Univ. and MPI

Department of Applied Physics, School of Engineering

Yukako Fujishiro

I visited ETH in Zurich, Switzerland on March 1st–2nd, and Stuttgart University & MPI on March 3rd, and it was a very wonderful visit especially because I was able to improve my communication skill through the interactions with people there. Everyone was so friendly and kind that I was able to discuss with them pleasantly. It was surely a great opportunity where I learned how I can broaden my view and expand the interchanges through my research work.

【3/1】ETH (Prof. Nicola Spaldin)

On March 1st, I visited Nicola Spaldin's lab in ETH at Zurich, Switzerland. Professor Nicola is a very famous theorist of multiferroics. First I did a seminar talk at the joint meeting with Manfred Fiebig's lab, and about 20–30 people came to the seminar. At first I was very worried because my research topic is not so close to the one in these labs, but finally I felt relieved because many people asked me questions. Furthermore, I was very happy to hear from the two professors that my research was very interesting.

After the seminar talk, I did individual meetings with Professor Nicola and some of her students. What most impressed me is that everyone seemed to love their own research and enjoy the discussion. I felt that they can enjoy their research life because they often discuss with other people in the lab and also enjoy their leisure time after the work every day and I think these are very important things.



Together with the two professors (after the seminar)

Also, Professor Fiebig and some of his students treated me for dinner. I enjoyed the meal while talking about Japanese cultures with Professor Fiebig, who likes Japan a lot, and also about how we spend our free time with the students. I learned how exciting it is to make friends with people all over the world through the research.



cheese-fondue dinner



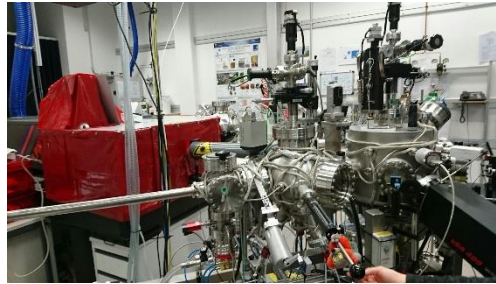
Together with Prof. Fiebig

【3/2】ETH (Prof. Manfred Fiebig)

On March 2nd, I visited Professor Fiebig's lab which is a very famous laboratory for experimental works on multiferroics through optical imaging. Professor Fiebig taught us about his newest researches and his students organized a lab tour for us and explained about their own individual researches. Everything was amazing and especially I was impressed by the concept and technology of measuring ferroelectricity of thin films by SHG and also the real time observation of polar domains. I think that "real-space" imaging is a very convincing method and I was strongly motivated to develop some real space observation probes on my own in the near future.



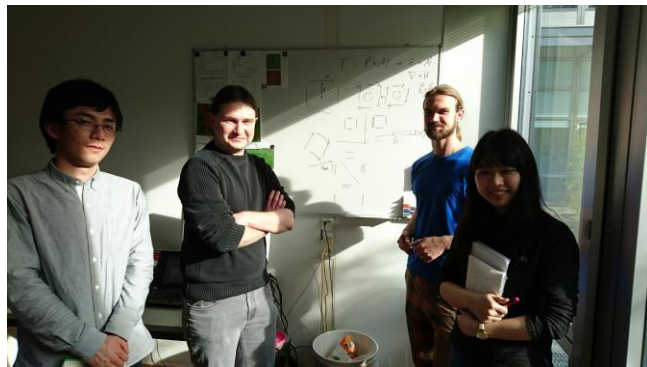
Observation of measpolar domains



PLD



Introduction of researches
from Prof. Fiebig



Discussion with theorists

【3/3】 Stuttgart University (George Jackeli) - MPI (Keimer' s lab)

On March 3rd, I first had a discussion with Dr. George Jackeli (theorist of Keimer' s group) and Mr. Yamada (MERIT student) at the Stuttgart University. They asked me a lot of critical questions on my research, which gave me very deep and new insights. In the afternoon, I visited Keimer' s lab and two post-doctoral students from the University of Tokyo showed me around the experimental setups. Also they taught me a lot about their research life in MPI and its difference from Japan, and I was able to have a clear image of studying abroad in the near future. I learned that it is important to challenge many things and broaden my view and the variety of techniques during the doctor course.



【Acknowledgement】

I would like to express my sincerest gratitude to Professor Takagi, Professor Nakano, and the students in MPI who organized our trip and lab tours. Furthermore I would like to thank Professor Tokura for giving me such a great opportunity at ETH. Thank you very much, and the experience at MPI and ETH will surely be helpful for my future researches.

Report for overseas training of MERIT course

Department of Applied Physics, 1st of Master course, Akishi Matsugatani

I visited Max Plank Institute for Solid State Research (MPI FKF) in Stuttgart, German and Max Plank Institute for the Physics of Complex Systems (MPI PKS) in Dresden as the overseas training of MERIT course. I report about the activities during this visit.

○2/27-28 At MPI FKF

On 27, Feb. we left from Haneda airport to München and then arrived at MPI FKF at night of 27, Feb. I have belonged to Takagi Lab. in MPI FKF for about 4 months during 4th grade of undergraduate student so it was second time to visit there and I felt some kind of nostalgia along the way. I explained about the different system of transport, guest house in MPI and Stuttgart city to my colleagues as the sub-leader of this travel like a tour-guide!

On 28, Feb. we attend the introduction of MPI, the Lab. tour, the facility tour, poster sessions and the welcome party.

At the Lab. tour, I saw the large PLD, the high-pressure synthesis and the chemical synthesis. Especially, it was really surprising for me that the PLD was so large and designed by members in Lab. Also in the facility tour I felt the stance like providing good environments for good researches. I think that is really great place for research activities.

At poster session, I reviewed the paper by my supervisor instead of on-going research but it was wonderful experience that talk with the experimentalist who focus on the same group of materials with my research. Of course, target phenomena were different but I felt my research could connect with others all over the world.

At the welcome party, we enjoyed Greek/German dishes and talking with foreign researchers who belong to MPI FKF.

○3/1-3 At MPI FKF and MPI PKS

From 1, Mar. to 3, Mar., I traveled with Mr. Fukui who belongs to Department of Physics. On 1, Mar., we had a discussion with Dr. Nakamura who was my supervisor last year in the morning and left to Dresden by ICE. On 2, Mar., we visited MPI PKS, made discussions with Dr. Oka and some other researchers introduced by him and attended two talks. On 3, Mar., we did some sightseeing around Dresden central station and then went back to Stuttgart.

In the discussion with Dr. Nakamura, I mainly asked about the experiment of anti-perovskite

films which I did in Takagi Lab. last year.

In the visit for MPI PKS, we attend the talk by Prof. Maeno and that by Dr. Basko. Both were really exciting. We also discuss with Dr. Oka, Dr. Slager and Dr. Erten. Dr. Slager takes various researches about formulation for nematic systems and classification of topological insulators by using the manifold and group theory. It really impressed me because of my interests in the way to understand physics from some mathematical aspects. Dr. Oka and Dr. Erten also gave me some useful advices about my research and it was great time for me.

○Through the whole days

During this travel, I had various talks and advices from a lot of researchers and it was wonderful experience to see the interest of Physics. On the other hand, I also aware that the environments surrounding researchers are really nice and I am really motivated to work in German or other foreign countries in future.

○Acknowledgement

This travel supported by Prof. Takagi, Dr. Nakano, Dr. Nakamura, Dr. Oka, Ms. Ulrike and Mr. Hwang. I really appreciate them for the success of this wonderful experiments.



Pic. 1 MPI FKF



Pic. 2 MPI PKS

MERIT Overseas Training Report

Department of Electrical Engineering and Information Systems

Nomura Laboratory M1 Yusuke Hata

In this paper I report about overseas training which was held from 27/2/2017 to 5/3/2017.

[Max Planck Institute in Stuttgart]

We went to Max-Planck-Institute in Stuttgart and saw their facilities. The first thing I feel is that the buildings are very clean and good environment for research in spite of not very new buildings. There are coffee machines at each floors and white boards on walls in public space. They promote discussion of researchers who work there wherever and whenever. Not only researchers but also a lot of engineers are employed there and there are a lot of machine tool they use. Although researchers do everything in Japan, many workers cooperate and accelerate their projects there.

I saw dilution fridges in Precision Laboratory. Precision Laboratory are built very carefully not to make any noise. They can conduct some kinds of measurement at 20 mK very steadily with dilution fridge.

[Fraunhofer IISB in Erlangen]

I visited Fraunhofer Institute for Integrated Systems and Device Technology (IISB) in Erlangen on 1st March. Dr. Bauer, who is the head of department of technology and manufacturing, explained about IISB and took me to their facilities including clean rooms (CRs). They research about power electronics such as semiconductors of vehicles, which is a little bit far away my research field. However, I was very interested in management of CRs so that I contacted him and visited.

They manage CRs with a university which is located by IISB. IISB gets budget from companies thus they can purchase equipment for fabrication but cannot pay electrical charges which is caused by equipment. On the other hand, a university gets budget from government thus can pay electrical charges but cannot manage equipment because of less professional technicians. That is why they manage CRs together. Workers at IISB maintain equipment and teach students at a university how to use equipment. I think the relationship of them is very good each other. It is difficult for us to take over how to use equipment because we graduate in few years and leave management of CRs.

[Max Planck Institute in Erlangen]

I visited Marquardt Division of Max-Planck-Institute for the science of the Light (MPL) in Erlangen. Marquardt group investigates nanophysics and quantum optics using optomechanics theoretically and I refer to their papers on my research, topological phononic crystals.

MPL was built last October so that it is very new and clean. There are a lot of discussion space as well as MPI in Stuttgart. Students are given one room for each other in Marquardt group.

I discussed about my own research field with Prof. Marquardt as soon as I arrived. He could understand my research and gave me advice because they collaborate the experimental optomechanics group. It was hard for me to discuss deeply about my own research with English thus it was very good experience. Then I present about my research to Prof. Marquardt and his students for 20 minute. I feel they could understand my research but do not seem interested in. I thought I will do research which is interesting even if not familiar people. Finally I heard from his students about their own researches. Their presentation is very clear and there are a lot of things I should learn. I am impressed when I talked with a student who wrote paper which I refer to.



Entrance Hall in MPL

[Freiburg University, IMTEK]

I visited Prof. Paul, who is a professor of IMTEK in Freiburg University, thanks to introduction of Prof. Nomura (my supervisor). In his laboratory they investigate applications using MEMS technology and now mainly focus on electrodes for brains, which is used in neuro science. Although I am not familiar with their research, I majored about flexible electronics when I was an undergraduate student thus I could understand their talking roughly. I discussed with 9 people each 30 minute about their research. It is quite hard to discuss with English for long time. I also saw CRs but they conduct micro-fabrication thus our facilities seems more useful. I was very surprised to technologies which pack everything to one chip.

[Conclusion]

I feel the difference between Japan and Germany about their system against research. In Japan researchers create ideas and fabricate samples and conduct measurement themselves. On

the other hand, technicians and engineers work their field such as fabrication or measurement, thus researcher's work is creating ideas for research. When we consider about achieving projects, German strategy seems good. However, it is good experience for students to do everything thus I think education for students in Japan is not inferior to Germany.

I am only student of department of Electrical Engineering, thus I traveled alone for three days. At first it was very hard for me to take bus or train alone. However, I accomplished all schedule. This training gave me courage.

[Acknowledgement]

I appreciate all people who support this overseas training.

MERIT Overseas Training Report

Naoya Fujiwara (Dept. Chemical System Engineering)

【2017.2.28】 Visit to Max Planck Institute for Solid State Research (MPI-FKF) [Group]

I spent all day in MPI-FKF with other MERIT members. First of all, I would like to thank our representative Mr. Hwang and MPI counterpart Ms. Ulrike, for organizing one day workshop.

The workshop started with the introduction of MPI. After that, each research group in MPI-FKF was introduced. In a laboratory tour, I joined the group for materials synthesis laboratories. I was amazed by the very large and quite precise apparatus for pulsed laser deposition. After lunch, I joined a facilities tour by Ms. Ulrike. She was so friendly as to answer our questions readily. Then Dr. Nakano presented about UTokyo and MERIT. In a poster session, I found that it was more difficult than I had expected to explain research issues to people those who were not familiar with the topic. During a dinner in a restaurant, I enjoyed talking with German researchers in Prof. Takagi's group.

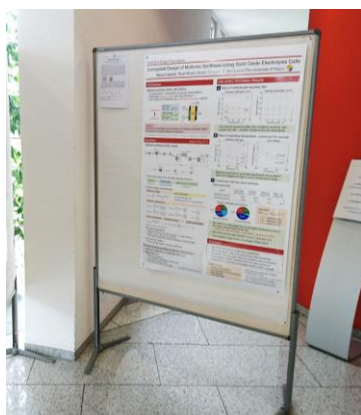
【2017.3.1】 Visit to Max Planck Institute for Solid State Research (MPI-FKF) [Individual]

I visited the Physical Chemistry of Solids group in MPI-FKF. I had an opportunity of talking to Prof. Maier, the group director. He asked me about the general trend of Japanese science and technology. I did not expect that kind of question and got somewhat puzzled, but now I think that question was an indication of his world-wide view. After the talk with Prof. Maier, I looked around the laboratory with Dr. Merkle, who conducts studies about solid oxide fuel cells (SOFC) in the group. According to her explanation, their main topic is SOFC cathode materials. Investigated materials are almost the same as our laboratory, but research objective and approaching method are much different. Their focus is on fundamentals while ours is on rather application side. We can learn a lot from their research. Dr. Merkle also gave me some beneficial advice on my own work.

After leaving MPI, I went sightseeing in Stuttgart city center and a neighboring beautiful town Esslingen.

【2017.3.2】 Participation in a conference [Individual]

On this day, I departed Stuttgart in the morning and arrived in Karlsruhe to attend an academic meeting named ModVal 14 (14th Symposium on Fuel Cell and Battery Modelling and Experimental Validation). I attended ModVal 14 because a group in Karlsruhe Institute of Technology (KIT) called IAM-WET, with which I had an appointment, was the host of the conference. I showed some research results in a poster. This was my first time to attend international academic meetings. Number of participants were more than a hundred, but I was the only Japanese person there. Therefore I was alone without communication. I found that my communication skill had to be improved. Through the conference period, Dr. Weber from IAM-WET helped me a lot. He introduced me to other German researchers at a conference dinner, and I could talk with those people. He also told me that I can visit KIT again if I want. I greatly appreciate it.



My poster in ModVal 14.



Invited talk (from conference website, arrow points at me).
<http://www.modval14.kit.edu/>

【2017.3.3】 Participation in a conference, Visit to Karlsruhe Institute of Technology (KIT) [Individual]
 This was the second day of ModVal 14. I listened to several oral presentations. In the afternoon, I left the venue and went to KIT. There I visited IAM-WET (Institute for Applied Materials, Materials for Electrical and Electronic Engineering). This group studies SOFC, batteries, and oxygen separation membranes. I cannot meet Prof. Ivers-Tiffée, head of the group, but a PhD course student Mr. Russner introduced all rooms for SOFC research. Those room were large enough and equipment in laboratory was kept tidy. It seemed like a very good environment to concentrate on research. My laboratory in UTokyo is smaller than IAM-WET, so I think it is important to consider how we can achieve good results and be competitive.



Scanning electron microscope with focused ion beam equipment.

【Summary】

This one-week training was a precious experience for me. At MPI, I could see laboratories in other research fields. In Karlsruhe, I was able to attend an international academic meeting. And at KIT, I could visit a laboratory whose research topic is very close to mine.

The biggest fruit of this trip was that I gained confidence in staying alone in a foreign country. This time the place was Germany, so it may be relatively easy to get ourselves understood. Nevertheless, it is still important for me that I could spend three days alone outside Japan.

【Acknowledgments】

I would like to thank teachers and staffs of MERIT program for preparing this opportunity. Especially Dr. Nakano helped us a lot to have a safe trip. I also appreciate hosts in Germany; people in MPI including Prof. Takagi and members of IAM-WET in KIT.

MERIT oversea training report

Akihiro Eguchi

What was the most stimulating in this training was a voluntary laboratory visit for 3 days. I stayed at ETHZ Hoggenberg in Zurich, Switzerland for two days and then stayed at Basel University in Basel on the last day. There are 6 Japanese postdoctoral fellows in the ETHZ laboratory (Hilvert Laboratory) I visited on the first day. Also there are many Japanese postdoctoral fellows throughout ETHZ, so I was able to disseminate knowledge about my research career abroad in addition to just visiting the laboratory. On the second day at Piel Laboratory, I told the professor directly and we had a fruitful discussion on the research. In the visit to Basel (Ward laboratory) on the third day, we had the opportunity to have time to discuss each research with lab members and to have the experience of appealing our research in English and I was able to deepen interactions with nearby researchers.

Through this training, I strongly realized two things. The first is "a consummate research environment". Though circumstances may change in other Western countries, the fact are factors that the funds are abundant and measuring equipment and facilities are substantial compared with the Japanese laboratory in regard to short working hours and high salary and so on. In addition, the system of technical staff / technician is well established, and I felt that the researchers have an environment that is easy to spend time for thinking their research project.

The second is "merit of spending research life abroad". To be honest, I was overwhelmed with the desire to leave Japan and to conduct research here as soon as possible during my three-day laboratory visit in overseas training. Not only the research environment set up as described above, the high degree of social recognition of doctoral students and doctor was entirely different from Japan. Also, salary of researchers is set high in Japan and is also paid to Ph.D. students. I think that there is almost no merit to acquire Ph.D. in Japan where we have to continue paying tuition fees.

Although it becomes a negative opinion, a summary of this training is that, "It felt a sense of crisis in the Japanese research environment". The above-mentioned matter is a case that has been regarded as a problem in recent years. In order to keep Japan a scientific developed country, I felt strongly that we should resolve these problems and focus on training capable researchers.

MERIT overseas training report

2017/2/27~2017/3/5

So Kunisada, Kondo Group, Dept. of Phys., Sch. of Sci.

Given the chance of attending the MERIT program, I visited the laboratories in Max Plank Institute for solid state research (MPI for solid state research) and Electronic Properties at Peter Grünberg Institute (PGI-6). I had a big anxiety, Because it is my first overseas travel alone. But, I was able to have fun. More people could speak English than I imagined, because the place I visited was a rural but research city.

Experience at the Max Plank Institute for solid state research

In MPI for solid state research, Mainly we visited the equipment and conducted a discussion. There are many different points from Japan and the goodness of the research environment beyond was fascinating. For example, I was surprised that the equipment we normally put in the basement, due to earthquake countermeasures, was casually placed on the wooden floor 1.5 because there was no earthquake. Furthermore, by attaching technical staff surely to the equipment, I was touched by the fact that the performance of the measuring equipment is always gathered at a high level. Also, in poster presentation in English, I was struggling to answer questions but after speech I was fluently fluent in Japanese and I was a bit stunned. I discussed with various people. Particularly in a discussion with students of the Dr. Kim group of Prof. Dr. Keimer Laboratories who are studying YBCO-based copper oxide high temperature superconductors, in the discussion with the students of the Dr. Kim group, I was able to increase my knowledge. In addition, Dr. Suzuki, postdoctor of the Dr. Minola group, told me about the equipment and current research in detail.

Experience at the Electronic Properties at Peter Grünberg Institute

I visited Prof. Dr. Schneider laboratory here. This laboratory uses angle resolved photoemission spectroscopy (ARPES) equipment as well as its own research. For that reason, there was a little connection, we asked for a tour of the impressive SP-resolved 2D simultaneous ARPES device in the laboratory lecture previously done. Unfortunately, although the equipment was in the process of being launched, we got a valuable opportunity to see the result of the synchrotron radiation facility, the parts before launch, the preparation stage before assembly. The splendor of overseas synchrotron radiation

facilities was noticed from a long time ago, but there are many topics of better synchrotron facilities that I do not know, I was surprised by the variety of variations.

Acknowledgments

We deeply appreciate MERIT program, Prof. Dr. Ichikawa, Prof. Dr. Takagi, Dr. Nakano and staff for this opportunity. I also deeply appreciate everyone at the host laboratory including Dr. Kim, Dr. Minola, Prof. Dr. Keimer, Prof. Dr. Schneider, and others.

Report of MERIT Oversea Training

Department of Physics, M1, Tateishi Ikuma

In 2017.2.27~2017.3.5, I visited research institutes in Stuttgart and Switzerland as a MERIT coursework. In this report, I write about the activity in the days of individual visiting.

In individual visiting, I visited ETH and Univ. Zurich in Zurich, and EPFL in Lausanne.

In ETH, I visited Sigrist group and Esslinger group. In Sigrist group, in the first instance, Dr. Sigrist talked me about the basic topics of topological superconductivity. Afterwards, a student in Sigrist group introduced her research, analysis of magnetic field distribution by phenomenological approach. In the evening, I participated in the colloquium, titled “Topological Superconductors and Majorana Fermion”. After the colloquium, I have a chance to talk with researchers and students who participated in the colloquium. In that time, I talked with them about the research life in Switzerland, and the treatment of Ph.D. students in



Europe. It was very impressive that, unlike the institute in Japan, student have to get a “post” to belong a research group. In Esslinger group, I studied the experimental stuff of cold atom systems. Afterwards, students in the group talked me about details of experiment, measuring transportation between the two parts of cold atom divided by LASER.

In Univ. Zurich, I visited Neupert group and studied about theoretical proposal on Weyl semimetals made of boronized materials and topological system with C_4 symmetry.

In EPFL, I visited Andrew, a postdoc of Mila group. In EPFL, there is only one group (Mila group) that major in theoretical physics. I was able to study about spin systems in the group. The research topics in the group were roughly divided into two categories. One of them is analysis on the $S=1/2$ systems with CFT or other techniques, and the other is the theories in $SU(N)$ spin systems. Especially in $SU(N)$ spin systems, it was very interesting that terms in equations are classified by using Young diagram, which I have studied in a textbooks of mathematics.

In this MERIT oversea training, it was very helpful for my future research activity not only to study the topics around my research subject, but also to talk with foreign students about research life in foreign countries. This training encouraged me to study abroad.

MERIT overseas study trip

Department of Physics 1st year of Master course

Tomoki Hirose

We travelled around Germany and Switzerland for one week from February 27th to March 5th in 2017. This trip offered us a great opportunity to visit different research institutes in Europe, where there is a different scientific community from Japan and US. Having talked with many researchers and students there, I have learned the recent research topics in the variety of fields and researcher's life in Europe.

2/28, Stuttgart (Germany), Max Planck Institute(MPI)

With the help of Prof. Takagi, a one-day visit was organized at MPI in Stuttgart. Firstly, each group leader made a brief introductory talk. Although I couldn't understand their research in details, it was interesting to know that the collaboration between theoretical and experimental groups was regarded very important. Afterwards, we had a short laboratory tour. As I belong to a theoretical group and not familiar with experimental probes, most of experimental equipment seemed massive and impressive to me, particularly the building called "Precision Lab". I was amazed by how much effort was made to obtain highly precise measurements.



3/1 and 3/2, Zurich (Switzerland), ETH Zurich and University of Zurich

In Zurich, Prof. Sigrist kindly hosted our visit. He works at ETH as a group leader of Strongly Correlated Theory. His interest lies mainly in the chiral p-wave superconductor, which he explained to us in the afternoon of 1st March. We also discussed with his PhD student about her recent work. After attending the seminar on Majorana fermions and topological superconductor, we met several students who can speak Japanese fluently. It was a good relief to speak one's mother tongue in a foreign country. On that night, we had a delicious dinner at Swiss traditional restaurant.

On the following day, Prof. Sigrist introduced us to two different groups, Prof. Esslinger's group at ETH and Dr. Neupert's group at University of Zurich. Prof. Esslinger's group is working in the area of cold atomic physics. We were able to see the laser and the collection of mirrors oriented to control atoms at extremely low temperatures. Two nice PhD students taught us how their research coincides with the study of correlated materials.



(left) Seminar we attended at ETH



(right) Prof. Sigrist's office in this building

Dr. Neupert's group began to work only from last year but they are already working on many projects. Again, people were very friendly to us and kind enough to explain their current projects from the background. Their research is directly relevant to our interests, which is focused in the topological insulator/Weyl semimetals etc. So, it was really helpful to listen to their lecture.

3/3, Lausanne (Switzerland), EPFL

On the day before the flight, we went to Lausanne and visited Prof. Mila's group at EPFL. Although Prof. Mila was not around at that time, his postdoc organized a seminar by most students in his group. Each one of them presented their research for about half an hour, and we could roughly understand problems on $SU(N)$ spin systems. It was interesting to know that the Young diagram could be used to count the number of all singlet ground states in $SU(N)$ systems.

Acknowledgement

I would like to thank for everyone who is involved in organizing this wonderful study trip. It was really a fruitful trip and gave me a confidence for communication in English. I am sure that this experience will be helpful in future to encourage myself challenging a study outside Japan.

Overseas Training Report on Germany

Department of physics

Hwang Yongtae

Student number : 35-166079

Thanks to MERIT program, I had great opportunity to visit Germany from Feb.27 to Mar. 5.

Mainly, I visited these Laboratory

①Man Planck Institute in Stuttgart

②B CUBE, Technische Unoiversität Dresden&Max Planck Institute of Molecular Cell Biology and Genetics

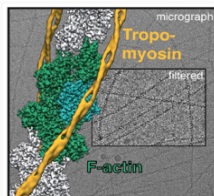
③Max Planck Institute of Molecular Physiology

Bellow, I describe my visiting more precisely.

③Max Planck Institute
of Molecular Physiology



Dr. Julian von der Ecken



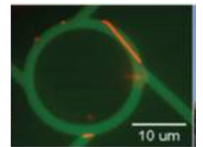
Cryo Electro Micro Scope



②
B CUBE,
Technische Unoiversität Dresden
&
Max Planck Institute
of Molecular Cell Biology and Genetics



Prof. Stefan Diez



Nano technology



①Max Planck Institute
in Stuttgart

Figure 1 summery of my visiting

(I quoted picture from each HP site)

①Max Planck Institute in Stuttgart

First, I visited Max Planck Institute in Stuttgart. Main research theme of this lab is solid state and intelligent system. In visiting MPI, I was interested in how to keep low noise level of AFM(Atomic Force Microscope) and TEM(Transmission Electron Microscope) , which are precise measurement method of determination solid state.

I think many laboratory set these experimental equipment on just vibration removal board to reduce noise. On the other hand, MPI built experimental building for reducing noise driven from vibration from outside (Figure2)!! Not only that, there are many sound absorption material inside of building, so it is very quiet(Figure3).

When I heard it, I feel MPI in Stuttgart is one of the laboratory which can measure solid state most precisely.



Figure 2 building for reduce noise



Figure 3 sound absorption material inside of building

②B CUBE, Technische Unoiversität Dresden

&

Max Planck Institute of Molecular Cell Biology and Genetics

I visited *Prof. Stefan Diez* Lab which research about motor protein in single molecular level. Because I research about very similar topic, I was really excited to visit this lab. Prof. Stefan gave me opportunity to give presentation about my research for researcher in this laboratory (Figure4). Because it is first time to give presentation in English, I had felt very nervous. After finish my presentation, however, audience said “your research and presentation is very good!” so I got great confidence which can’t get in Japan.

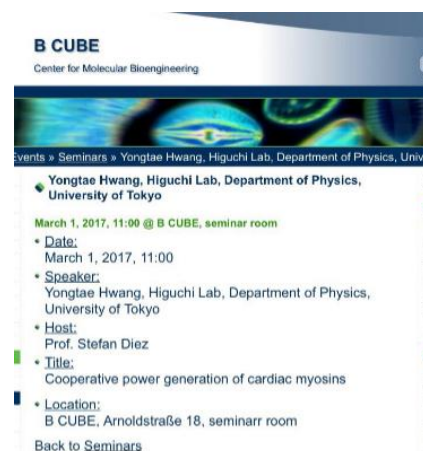


Figure 2 announcement of presentation

I think this presentation is most significant and impressive event for me.

③Max Planck Institute of Molecular Physiology

I also visited *Prof. Stefan Raunser* Laboratory which research about myosin which is one of muscle protein by using Cryo-electro microscope (Figure5). *Dr. Julian von der Ecken* guided me and he showed me laboratory and facility and his reserach.

He is very famous in myosin resercher because he published many time on very famous science magazine(Nature, call, and so on)

I was really surprised in his guide because there are loud music in experiment room. I have no idea whether music affect result of experiment, but it is very rare if loud music is in experimental room in japan, so I felt difference between Japanese experiment culture and German ones.

Also I was surprised on size of Cryo-EM. It is very huge that I thought (Figure 6)!

In my usual experiment, I also use myosin, so I can discuss what difficult process in experiment is. I could understand what is difficult process and why it is difficult by using EM method, which is totally different of difficulty of my research, because experiment purpose and method is different.

This story is very interesting for me, and I felt really grad to be able to discuss with great and famous myosin researcher.

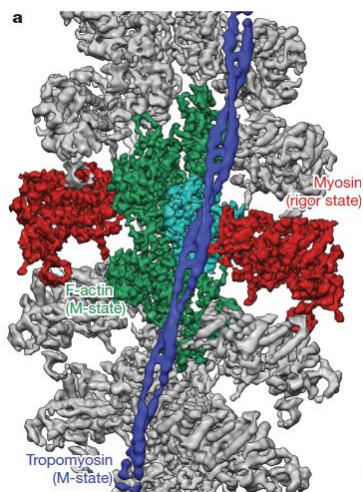


Figure 5 structure of myosin (*Nature* 534 724 (2016))



Figure 6 Cryo Electro Microscope (which name is “Titan”)

(I didn't take picture of this EM, so I quoted picture from https://www.embl.de/services/core_facilities/em/equipment/titan_krios/)

I would like to summarize what I learn through overall overseas training on Germany

1st. I can realize my English speaking skill is still miserable, because I was very hard to communicate with foreign people including Professor, researcher and ordinary people.

2nd. I can built confidence that abroad researcher are interested in my research, which maybe stand for my research is world crass.

3rd. I felt difference Japanese experiment culture and German ones through visiting some Laboratories.

Finally, I would like to say thanks to MERIT Program for give such a great opportunity to experience of visiting abroad Laboratory, to Prof. Takagi, Prof. Ichikawa, Mr. Matsugatani, and especially Ulrike who are organizer of scheduling MPI visiting for arrangement schedule of our visiting MPI and to Dr. Nakano for leading our transportation between Japan and Germany.

2017/02/27-2017/03/05

MERIT Overseas Training

Department of Physics

Kiyu Fukui

2/28-3/1: Stuttgart

In February 28th, we toured Max Planck Institute for the Solid State Physics (MPI-FKF). At first, staffs from every groups in MPI-FKF introduced their laboratories to us. Then we toured laboratories and experimental devices of Takagi group. I looked on Scanning Tunneling Microscope. I was surprised to the laboratories called "Precision Laboratories". Each precision laboratory look like a box. They have own bases made of concrete and soundproof walls for accurate measurements. I was interested in cooling apparatuses for materials using helium and quasiparticle interference of Bogoliubov quasiparticles. After lunch, Dr. Nakano introduced MERIT program to MPI staffs and then we made poster presentations to researchers and students in MPI-FKF. My poster is about odd-frequency superconductivity in strongle correlated electron systems under magnetic fields. Odd-frequency superconductivity is not known well, so I tried to introduce it as politely as possible. It was very difficult because my English ability is low level. I disscussed not only researches but also difference in graduate school systems and everyday-life between Germany and Japan with students in MPI. After poster presentations, we went to a restaurant in Vaihingen and had dinner with researchers in MPI-FKF. I sat next to Prof. Dr. Manske. My field of study is unconventional superconductivity and I sometimes read his book about theories of unconventional superconductivity, so I was very happy to talk him. He was very kind and we talked a lot.

In March 1st, my friend Matsugatani-kun and I met Dr. Hiroyuki Nakamura in Tkagi group. We introduced each study. I was very interested in the study of superconductors that Dr. Nakamura said.

3/2-3/3: Dresden (MPI-PKS and MPI-CPfS)

Matsugatani-kun and I visit Dr. Takashi Oka in Max Plank Institute of the Physics of Complex Systems (MPI-PKS) and Max Planck Institute for Chemical Physics of Solid (MPI-CPfS). He adjusted to allow us to discuss with the researchers in MPI-PKS. We introduced our research and disscussed with Dr. Peter Fulde, Onur Erten and so on. Prof. Dr. Yoshiteru

Maeno came to Dresden for seminar and we attend the seminar in MPI-CPfS. The seminar was about superconductivities in Ruthenium oxides and Anti-perovskite oxides. I was interested in topological superconductivity in anti-perovskite oxides and half-quantized fluxes in superconducting ruthenium oxides. After lunch we asked him some questions. I discussed with Dr. Oka about his works and I obtained some ideas.

Overall Impressions

Through this training, I once again recognized the importance of English ability and realized my low English ability. English ability is very important for smooth discussion. My motivation to study English grew. My motivation to study in foreign countries also increased. I would like to participate in Long-term overseas research in MERIT program.

Acknowledgement

I would like to thank all professors and staffs of MERIT program who are related to this training, especially Prof. Dr. Hidenori Takagi and Dr. Masaki Nakano, MERIT 6th students who participate in this training, and all of the people I met in this training.

MERIT overseas training report

Zhendong Chi, Fujimori Group, Dept. of Phys., Sch. of Sci.

Given the chance of attending the MERIT overseas training, during 2/27 to 3/5, I visited two research institute in Stuttgart and Karlsruhe, Germany.

2/28 Overall introduction of Max Plank Institute for solid state research and the poster presentation

In the first day of our visit, we got the overall introduction of Max Plank Institute and the research contents of all the nine groups in MPI for solid state research. We also showed our own research by poster presentation. The most impressive one in the introduction and visit trip was that there is lots of space for scientists to discuss with each other freely. In one group, there are lots of subgroups and they can collaborate inside the group. In the poster presentation, I had the nice chance to discuss with the scientists and students from many different areas and got lots of advice. This made me to have some new ideas of my research.

3/1-3/3 Free time activity

We also had a free time during 3/1 to 3/3 to visit the groups we had interest. In the free time, I visited Keimer group in MPI, Wulfhekel group in KIT and Mannhart group in MPI, too.

3/1 Visit of Keimer group in MPI @Stuttgart

In Fujimori group I belong to, the main research methods are angle-resolved photoemission spectrum (APRES) and X-ray magnetic circular dichroism (XMCD) based on synchrotron radiation. We use these two methods and X-ray photoemission spectrum to study electron configuration and magnetic properties of many different materials. In Prof. Keimer's group, the main research methods are also based on synchrotron radiation. I'm appreciative that Prof. Keimer arranged a very full and meaning schedule for me and I could have so nice chance to see the instruments and discuss with his group's members. The research methods of Keimer group are central of synchrotron radiation, but now, they have had the instruments from terahertz to hard x-ray, almost the all range of light which could be used to study materials. Not only collaboration with material groups, but also they have instruments to grow single crystals and thin films. With another theoretical subgroup, it's amazing for that they could almost complete all the processes of research if they have an idea.

3/2 Visit of Wulfhekel group in KIT @Karlsruhe

My research term is the study of magnetic material's properties by using XMCD. In order to learn some more research methods of magnetic materials, in second day, I visited Wulfhekel group in KIT who is major of STM and spin polarized (SP-) STM. KIT is a university-institute complex and an investment focus of German government. Lots of interesting research results have been found by KIT.

Wulfhekel group where I visited has five STM and SP-STM instruments. One of them could reach 11mK ultralow temperature during measurement. It is clear to see the strong ability of instruments and the surprising amount of funds. The main aim of this visit was the discussion with the postdoc Dr. Hervé in Wulfhekel group. Dr. Hervé is now using SP-STM to research similar samples that I am also studying. By the discussion, I got lots of useful information for my own research.



Landscape of KIT.

3/3 Visit of Mannhart group in MPI @Stuttgart

In the last day of our visit, I visited Mannhart group in MPI who is famous for the growth of materials. For belonging to a group major of measurement, it is very important to have the communication with material group. The PLD instrument in Mannhart group is the only instrument in the world which is *in situ* from sample growth to all the sample solving process and basic measurement. The ability and the shape of this instrument are so fantastic. By discussing with other scientists and students in Mannhart group, I got lots of samples' information which I could measure in the future.

Acknowledgements

I'm very appreciative to MERIT staff to organize this overseas training. Especially to Ichikawa-sensei for operate this program, Takagi-sensei and Nakano-sensei to lead us during the visit. In the end, I would like to thank MPI for solid state research and KIT to give me the chance to have this visit.

Report for Feb. 22th- Mar. 5th, 2017, Stuttgart
Yamato Komatsu

I visited to Hilvert Laboratory and Piel laboratory in ETH Zurich in my personal activity period. In addition, postdoc researchers of these lab have guided us to Dobe lab and Carreira lab. in ETH Zurich. In this report, I mention the visit to these lab.

I met Prof. Hilvert, the director of Hilvert lab and made some discussion about our research. In addition, we had Postdoc researchers of the lab guide lab and its facility and make presentation of what they research now and discussion. In Hilvert lab, they mainly research directed evolution. Having listened about research themes of postdoc researchers, I felt this lab adopts various techniques for their research and there is also of flexibility in their researches. Especially, I met the postdoc researcher who conceived from what is researched in this lab after his coming and research about it now. Having listened his talk, I felt in this lab, researchers stimulate each other and come up with interesting research themes.



Next, I visit Piel lab and met Prof. Piel. He is very kind person and we made presentation to him about our research and made discussion about them. He spent his precious time and also talked about researches that is conducted in his lab and answered our questions. Having listened about his talk, I got very interested in enzyme function for natural (toxic) products.

ETH has shops of reagents in this under floor, and the researchers can purchase the reagents immediately in their buildings. I think that system is very convenient and it accelerate researches and experiences, considering which step can stuck researches. In addition to this, I was impressed about the system of Ph.D in Switzerland. In Switzerland, the Master course and the Doctor course are divided as with the system in Japan. However, few students are in the same lab for around 3-5 years like Japan. In Switzerland, fundamental education is emphasized and most of students study in many laboratories and stay there around three months. Although this system has some demerits, for example about building achievement of researches, I think this system has a lot of merits. Staying the same lab in long time might prevent students to widen their field of vision about researches, make students study about only their filed and not allow students to select their suitable assigned lab from a lot of choices. Having listened about that system, I thought this system is very interesting and the flexible system may have some emulated points for us.

MERIT Overseas Training

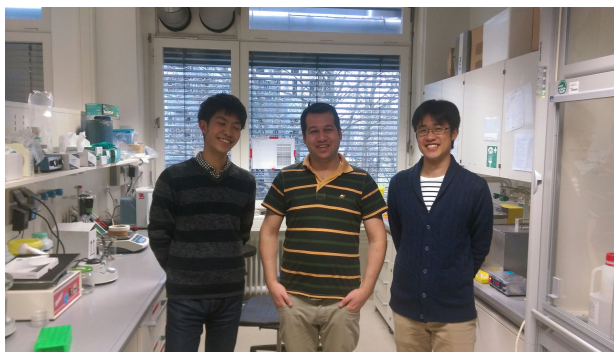
Department of Chemistry, M1

Ryosuke, SEKINE

I visited Heidelberg University, Max Plank Institute Mainz and Wuerzburg University from March 1 to March 3. These three places were chosen by following reasons; related to my own research, varied in terms of scale and organization to know overseas research activities from a broader perspective. I could take appointments smoothly with recommendation of Professor Nakamura, who is my supervising instructor. Therefore, I realized the necessity of connecting with overseas researchers before going to Germany.

3/1 Prof. Dr. Tanaka Laboratory @ Heidelberg University

Prof. Tanaka Laboratory researches the monomolecular film using organic molecules and the pathological mechanism of the cell. On that day, Professor Tanaka was absent, and Dr. Abuillan guided us. About 20 members are working in this laboratory, but most of them spent early spring vacation, and there were 3 postdoctoral fellows and 3 students when we arrived at the lab. We introduced own researches each other and discussed them. Then we toured the facility. I felt that the size of faculty is not much different from that of the University of Tokyo. In terms of studying the monolayer, they have a total of 6 Langmuir and Langmuir-Blodgett Troughs and other technical devices, and the layout of these machines are well-organized. In addition, I was able to get a specific image, that the states of molecular aggregates are evaluated mainly by spectroscopy, by receiving an explanation with seeing the apparatus,

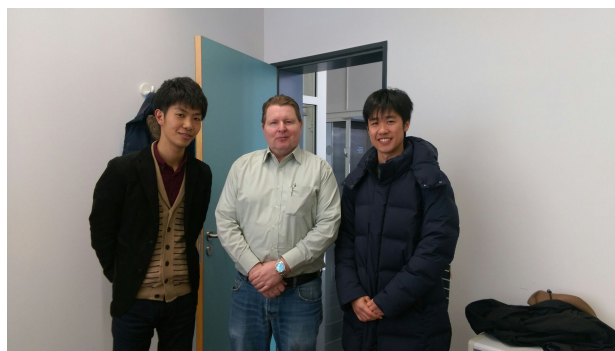


Dr. Abuillan (Center), Mr. Hanayama (right)

3/2 Max Plank Institute For Polymer Research

I visited all laboratories of the Max Planck Institute of Polymer Research on March 2nd. Specifically, I visited laboratories of 5 directors; Prof. Dr. Paul Blom, Prof. Dr. Mischa Bonn, Prof. Dr. Hans-Jürgen Butt, Prof. Dr. Katharina Landfester, Prof. Dr. Tanja Weil. We discussed own researches with 11 professors and group leaders every half hour

Since I was given a list of them on the day, I had a hard time in a situation that I had to discuss various researches without advance studies. That experiments trained me well about speaking and communicating skills in English.



Dr. Ingo (Center), Mr. Hanayama (right)

Max Planck Institute for Polymer Research is a leading institution, which reported more than 300 papers annually. I realized, that when comparing with the Japanese laboratory, the laboratory of the Max Planck Institute was active in collaborative research with others. I felt that utilizing the advantages of each other's technologies and acknowledge lead to success of the researches.

After the laboratory tour, I went to dinner with Dr. Yuki Nagata who is a group leader of Bonn laboratory. He gave me a talk about his history of chemist and how to interact with other researchers of Japanese and overseas

3/3 Würthner laboratory @ Wuerzburg University

The Würthner laboratory studies preparation of nanostructure by using aggregates of π -conjugated compounds, and application to devices. About 50 members (six of them are technicians) belong to the laboratory. I was so surprised that the research group has new and wide facilities and sophisticated system although it belongs to the university. In addition, I noticed that, safety and health of researchers during experiments is more carefully considered, although it is also a laboratory of organic synthesis. There are several rooms only for night experiments and rooms for experiments with reagents which have strong smells. After the lab tour, Dr. Kazutaka Shoyama, who is alumni of our group and works at WÜRTHNER laboratory, to told us about the living in Germany and the atmosphere of the laboratory etc. .

Summary

I learned that it is possible for me to discuss scientific terms in English at minimum through this overseas training, but I also felt that I should improve my English skills in everyday conversation and research discussions with vocabularies and expressions in high

level. In addition, from many opportunities to talk with Japanese researchers who work in Germany, I got a concrete image of jobs in overseas, and increase a motivation for studying abroad. I would like to make use of this valuable experience for my future research activities and careers.

Acknowledgments

This overseas training was finically supported by MERIT program. Here I would like to thank all the professors and staffs who planed this trip. Prof. Takagi and Dr. Nakano helped us a lot during our stay in Germany. Also I would to express my thanks to Prof. Tanaka, Prof. Landfester, Prof. Würthner and all the other people I met in Germany. Lastly, I want to thank all the MERIT students in this overseas training especially the group leaders. All of you made this trip joyful and meaningful.

Report of MERIT overseas training in Germany

School of science, Department of Chemistry, M1
Nakamura Group Hiroki Hanayama

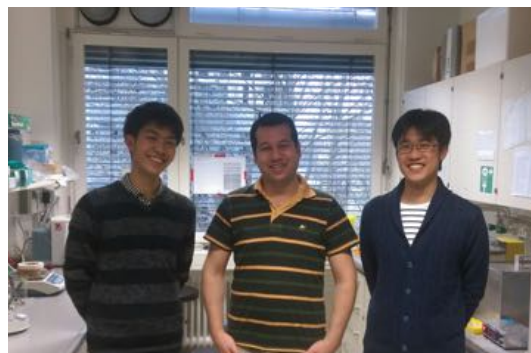
Thanks to the assistance of this overseas program, I visited Max Plank Institute for solid-state physics on 2/27, 28, Heidelberg University, Max Plank Institute for polymer research and Wurzburg University. I will report my experience in this program.

2/27, 28 Max Plank Institute for solid-state physics

At first two days of the program, we visited Max Plank Institute for solid-state physics. The staff from MPI explained the structure of MPI and their research. Then we toured the facility and joined poster session. Finally, we had a get-together with the member of MPI. This visit impressed on me two points. One is that MPI has a facility of technical officer for manufacturing devices for experiments. It can be installed not only because MPI has a big budget, but also because each laboratory co-works together tightly as a member of MPI. The other point is about English skill. At get-together with the people from MPI, I learned that there is a difference between communication in presentation and daily conversation. Further improvement of English skill is required to study abroad.

3/1 Tanaka Group, Heidelberg University

I visited Tanaka group at Heidelberg University with Mr. Sekine and toured their facility, and then discussed our research issues. Tanaka group investigated about physical property of membranes and colloids. The field of the research is different from mine, however, the visit gave me new

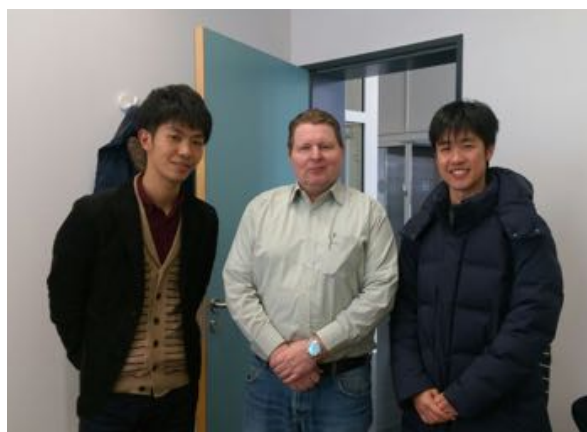


Dr. Abuillan who take care of us (middle), Mr.Sekine (left) and me (right)

insight of research. Especially, a spectroscopic investigation of internal structure of colloids can be applied for my research.

3/2 Landfester group, Max Plank Institute for Polymer research

On 3/2, I visited Max Plank Institute for Polymer research (MPIP). Though I had an appointment with Landfester group, discussion with more than ten of project leaders belongs to not only Landfester group but also other groups in MPIP was scheduled. It was very



With Dr. Lieberwirth, who managed schedule on 3/2

hard, but it was helpful and valuable experience for me. Most impressive thing in the discussion with each group leader in MPIP is that they have a active interest in cooperative research. I think we should learn from their attitude to do research collaborating each other with their specialty.

3/3 Wuerthner group, Wurzburg University

On 3/3, I visited Wuerthner group at Wurzburg University. I toured their facilities and discussed with project leaders. The environment for researchers in Wuerthner group is adjusted well, therefore they can focus on their research without other chores. For instance, there are technical officers who manage the devices and reagents, and



Experimental space in Wuerthner group

there is dishwasher for glassware. Moreover, experimental space for one researcher is sufficient, so I thought I would like to conduct research in the environment like this.

Summary

In this program, I recognized their efficiency in the research and systems like their positiveness to cooperative research and technical officer. This point is different from Japanese culture in laboratory. This experience motivates me to study abroad in future.

Acknowledgements

I am very grateful to Prof. Takagi, Dr. Nakano and other staff members, who managed and guide us in this program. Also, I appreciate the members of the groups, which accept my visit. Finally, I thank Mr. Huang and Mr. Matsugatani, who lead us as representatives of students.

“After MERIT overseas training”

GSFS, the department of Advanced Materials Science, Ito&Yokoyama lab
M2 Yusuke Yasuda

This year's MERIT overseas training was held from Feb. 27th to Mar. 5th. We flew to Germany on Feb. 27th, and visited Max-Planck Institute for Solid State Physics for 1 day, and each member visited labs they want to visit for 3 days, and returned to Japan during Mar. 4th to Mar. 5th.

In the visit to Max-Planck Institute for Solid State Physics in Feb. 28th, we held a workshop consisting lab tour and campus tour by MPI students, and poster presentation by MERIT students. Among them, poster presentation became a beneficial workshop since there were lively discussions between MPI researchers and MERIT students. Since I had not made presentation overseas, discussion in English was very exciting. Also, I realized that I was able to convey my research fully, as a result of preliminary presentation practice. This was a very good experience. I got not only a favorable reception but also a tough question, so I felt regret and at the same time saw future works, and so this was also a very good experience.

As for free visit during Mar. 1st to 3rd, I visited Max Planck Institute for Polymer research (MPIP) during former two days. Here I visited the laboratory of Prof. K. Kremer who established "bead-spring model" which is a model of polymer for coarse-grained molecular dynamics simulation that I am using now. On the first day, I met a Japanese researcher at Kremer laboratory who belongs to a Japanese company and was studying in K. Kremer laboratory, and asked about his own research and recent laboratory trends. I was also taught how he entered Kremer laboratory and equipment for calculation in Kremer lab. Regarding the scale (number of nodes, processing capacity) of the computing facilities owned by K. Kremer laboratory, it was not so different from Japanese computational research laboratory, but I felt access to the shared computer was much easier. On one hand application forms have to be submitted to use supercomputers in Japan and it takes much time for review, on the other hand, in MPIP they only need the signature of Prof. K. Kremer to use it. That enables challenging research to do. And in terms of research efficiency, I felt MPIP was a very good environment. On one hand, Japanese community of computational polymer science tends to underestimate the actual chemical structure to convey large-scale simulations which are directly linked to macroscopic physical properties, and optimization of the coarse-graining parameter tend not to be done. On the other hand, I learned in this interview that European community of computational polymer science often creates a relatively small model imitating the chemical structure of polymers. Personally, there are many parts that I can sympathize with this bottom-up way that were also contained in research concept of K. Kremer laboratory, so I felt that in the future we'd like to collaborate with K. Kremer laboratory and that during my Ph. D course I'd like to stay for about 3 to 6 months and learn the calculation method.

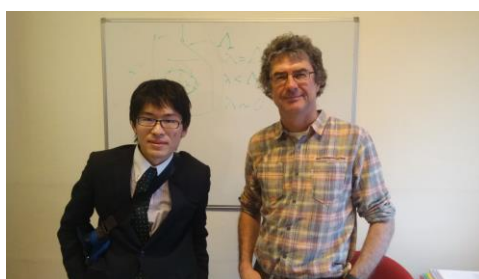
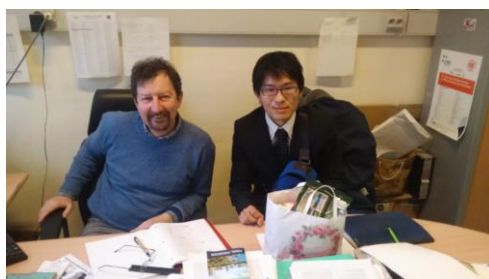
On the second day, I held a seminar at Kremer laboratory and discussions. The seminar was successful and it made me self-confident, and in the discussion with Prof. K. Kremer I was able to

be given advice and comments on mainly microscopic analysis, as seen by computational researchers. After that, I was able to discuss with researchers who are conducting research on network polymers, and I was taught a lot about analysis methods. At last, I was able to hear recent research on methods to reduce the computational cost. Until now, I have been using heavy calculations in the way of the original work [1], however, these studies will be absolutely necessary for dealing with large scale systems in the future, so it was very beneficial to obtain this information.

On the third day I visited the C. Creton Group in the école supérieure de physique et de chimie industrielles de la ville de Paris (ESPCI). Here they are aiming at elucidating the fracture mechanism of physical gels and toughening by doing consistently from synthesis to evaluation and analysis. Since my goal is to clarify the dynamics of slide-ring materials by both experiments and calculations, there are much overlapping part, so that I visited his lab. I first discussed with Dr. T. Salaz, who specializes in coarse-grained molecular dynamics simulation and theoretical construction, and introduced our work to each other. After that, Ph.D student gave me introduction of research facilities, then I made a seminar presentation, and finally I had a discussion with Prof. C. Creton and Prof. H. Dominique, the laboratory managers. It was a great harvest that I was able to make personal connections here. Especially since my research style was very close to Mr. Salaz, he was especially interested in my research and we got along soon. It was a great harvest that I was able to make acquaintance with students who are planning to participate in the summer school that I am planning to participate this summer. At the seminar, I was able to hear about the information about interests of experimental researchers, so I thought that it was a very good opportunity to think of what to calculate in the future. Furthermore, in the discussion with the two professors, I can receive sharp advice on the dynamics observation experiment of gels which I am doing. I felt that it was very meaningful visit.

After this training, I think that I was able to learn quite a lot by putting myself in a completely different environment even in the short term of 4 days. Therefore, I felt very strongly that I wanted to stay in a foreign laboratory for a longer period of time and actually want to do research.

Finally, I would like to express my deepest appreciation to Professor Ichikawa, Lecturer Nakano, Professor Takagi, who planned and managed this overseas program, and MERIT secretariat for financing investment in this project, and Professor Kawasaki.



At professor room of ESPCI, left: with Prof. C. Creton, right: with Prof. H. Dominique.

References : [1] K. Kremer and G.S. Grest, J. Chem. Phys., 92, 5057-5086 (1990).

MERIT overseas training

Dept. Advanced materials science M1 Yusuke Araki

In this overseas training, I visited Max Plank Solid Institute (MPI) and Swiss Federal Institute of Technology in Zurich (ETH).

1. 2/28 MPI

On the first day 2/28, all of us visited MPI in Stuttgart. Due to my first visit to a laboratory overseas, the atmosphere of research facilities and researchers was different from that in Japan. For example, it was very impressive that coffee makers were installed in the hallway, and researchers hold a discussion at a table near it. I felt "brightness" throughout the research facility. Of course, the experimental equipment was also wonderful. I felt that the commitment to the measurement system was stronger. The structure of the research facility as a whole was devised so that measurement systems such as superconducting magnets and TEM do not pick up noise from the surroundings (see also below). In the facility seen in Fig. 1, the rooms are divided in the building. The boundary of each room is almost completely separated from other rooms, so that vibrations can't propagate.

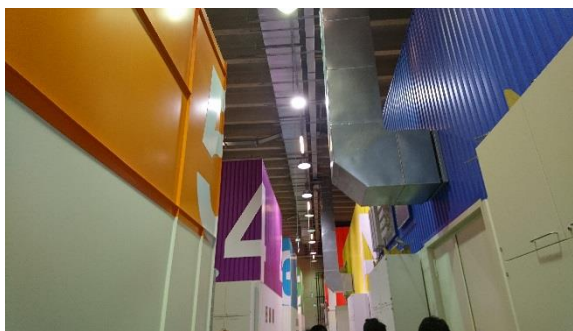


Fig. 1: Measurement systems devised for each room

The poster session in the evening was also very meaningful. It was impressive that there are more Japanese researchers than I thought.

2. 3/1,2 ETH

On the first and the second day of free activity, I went to ETH in Switzerland and visited M. Fiebig group and N. Spaldin group. Both of them are research groups which have very wonderful achievements in both experiments and theories in the field of multiferroics and it was a very stimulating experience for me to visit.

Firstly, at the seminar of both groups, we had a presentation about our own research for about 20 minutes (Fig. 2).

Next, we discussed the research one by one with members of Spaldin group, the theoretical research group.

Following the presentation, they listened to my talk



Fig. 2: With two professors after my presentation

carefully and I received valuable advice and suggestions.

On the second day, Professor Fiebig gave us some explanations of the research theme of the laboratory, and we visited the experimental equipment. Among them, the most impressive one is a device used for domain observation such as PFM and AFM. After I looked at the measuring device and the photograph clearly reflecting the multiferroic nature and magnetic structure, I wanted to use these devices.

It is common for both groups that not a few members of any laboratory have researchers who major in experimental or theoretical analysis. Also, there is a strong connection between the experimental and theoretical groups, and the seminars are jointly carried out. It seems to be ideal to establish such a relationship in the university environment, also in the nearby laboratory (actually, both groups have also published articles in co-authorship).

3. 3/3 MPI

On the last day, I visited Dr. J. Folson who is the OB of my laboratory and researching at MPI. Compared with the first visit, we had enough time, and he explained the detail about low temperature technology. Although I described some contents again, MPI devises the design of the building so that noise does not get on high precision equipment such as TEM. In addition to the seismic isolation structure, the vacuum pumps for low temperature were installed in a room separated from the measurement system. I heard that they also make such a request when they consider this construction in arranging such facilities. Regarding low-temperature technology, he showed the probe and taught us how to cool down to around 15 mK (because we are not very familiar with cryogenic techniques, he explained them to the detail.) Also, other people in the same lab were so cheerful that they answered kindly our questions about equipment.

Acknowledgement

I would like to thank Professor Takagi, Professor Nakano, and MERIT officials who gave us these opportunities.

In addition, I am deeply grateful to the members of the research group who I visited for their kind acceptance.

Report of the MERIT overseas training
Graduate School of Frontier Sciences Department of Advanced Materials Science
Shibauchi laboratory M1 Kousuke Ishida

This March I visited Germany in our overseas training program. Here I report what I learned in this program.

【2/28 Max Planck Institute For SOLID STATE RESEARCH】

This day all of the MERIT students joined the workshop with Max Planck Institute (MPI). At first there was the introduction of MPI. It is said that MPI department exists not only in Germany but also in foreign countries and this April new branch will open in Tokyo. After that representatives of each department introduced their research topic. It was very impressive that many research group focus on the cuprates, which is the target material in my study.

Next there was a tour of the laboratories in MPI. One group has many cryogenic systems which allow us to measure under high magnetic field (up to 12T) and at low temperature (about 100mK) and another group used scanning tunneling microscopy under 'noise-free' environment which is shielded from external vibrations (precision laboratory) . There was research group who investigate the relationship between apical oxygen and superconducting transition temperature by using scanning TEM in La-based cuprates, which is most impressive for me.

The poster session held at evening. The researcher in MPI came to listen to me. I felt honored they got interested in my measurements.

【3/1 Karlsruhe Institute of Technology Institute for Solid State Physics】 (individual activities)

On the first day of individual activities I moved from Stuttgart to Karlsruhe (about an hour by train) and I visited Christoph Meingast group at Karlsruhe Institute of Technology (KIT) Institute for Solid State Physics (IFP). I made an appointment with Prof. Kai Grube, who is the coworker of our research group, but he was out because of the Quantum Criticality & Novel Phases meeting in Berlin. Therefore his PhD students Sebastian Kuntz guided me to KIT campus.

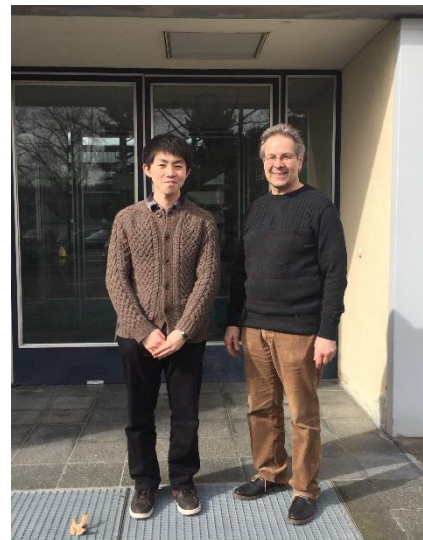
KIT has two campus, South and North. South locates near the central station but North is a 20 minutes' drive from the central station. Most of the undergraduate students go to South and there are many research facilities in North. This time I visited Institute for Solid State Physics in North.

They investigate thermodynamic and transport properties of the unconventional superconductors such as iron-based superconductors and heavy-fermion compounds. They also makes oxide thin films and uses neutron scattering.

At first they showed me thermal expansion measurement system. Thermal expansion is closely tied to heat capacity and thermodynamic quantity which is powerful tool to probe thermal phase transition. Change in sample length can be measured by the change in capacitor gap. By measuring the change of capacitance their system achieved a very high length resolution of 0.1–0.01Å. They also evaluate

the nematic susceptibility from shear modulus by using three-point bending machine. Now they are setting up the light system to measure thermal expansion under rotating magnetic fields by applying rotator to probe. There are few research groups in Japan who measures the thermal expansion but it is very useful method to prove electronic nematicity. I got very interested in this powerful method.

Next I meet Dr. Thomas Wolf, who is mainly engaged in the crystal growth of their group. He guided me to synthesis rooms. He is the person who made a major breakthrough in synthesis of FeSe, which is energetically studied nowadays. Our research group (Shibauchi Laboratory) measures the sample grown by him and I was surprised the high quality of his single crystals. He is going to retire this March so I was very lucky to meet him in his last days. He showed me many chemical synthesis room and X-ray measurements room. I was overwhelmed by his extensive knowledge cultivated through many years. He explained me very cheerfully and I was very impressed his words; “Don’t forget sample is not always good. This is important. Very important.”



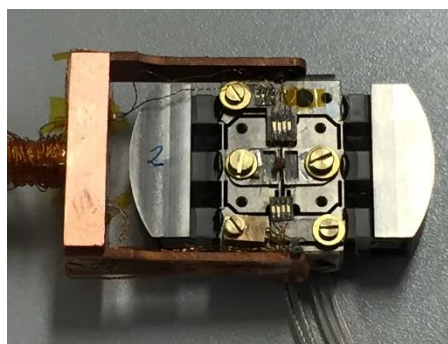
Dr. Thomas Wolf

After that I met Dr. Christoph Meingast, who is the head of group, and discussed my research topics. He seems interested in my research and gave me the meaningful information. After having lunch I listen to the PhD. students who uses neutron scattering. He goes to France to do neutron scattering measurements.

What is most impressive in KIT is researchers in different fields (chemical synthesis, neutron scattering etc.) have a coffee time together every day. I think we cannot really see this kind of view in Japan.

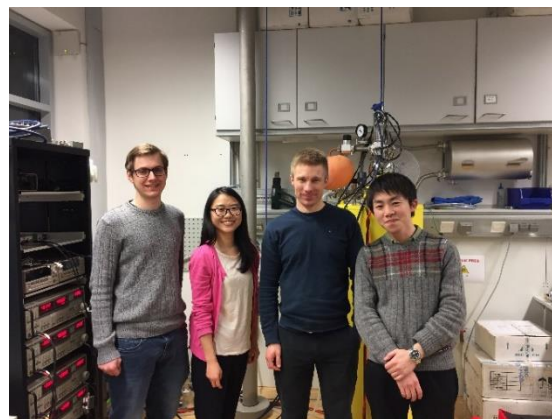
【3/2 Max Planck Institute For Chemical Physics of Solids】 (individual activities)

The next day I flied from Stuttgart to Dresden (about an hour) . I visited Max Planck Institute For Chemical Physics of Solids strain tuning group. I made an appointment with Dr. Clifford Hicks who is the leader of the group. He is the pioneer of measurements under uniaxial strain and piezoelectric-based apparatus developed by him can induces up to 0.2% strain. During my visit Mr. Suguru Hosoi, who is a senior student in Shibauchi Lab, stays in MPI Dresden as a short term visitors. He explained me the uniaxial pressure cells and we discuss how to adopt this technique for our experiments.



Piezoelectric-based
uniaxial pressure cells

From eleven there is the seminar given by Prof. Yoshiteru Maeno from Kyoto University. The talk is mainly about the antiperovskite oxide superconductor which has the prospect of topological superconductivity. It will be needed to probe the pairing symmetry in this new superconductor. After having lunch I saw the Suguru's experiments and listened to one who measures the resistivity and heat capacity of ruthenide under controlled strain. Now they are trying to combine this uniaxial pressure cells to other measurements. I am looking forward to seeing how this technique will be developed in the future.



Strain tuning group members

【3/3 Max Planck Institute For SOLID STATE RESEARCH】 (individual activities)

On the last days I returned to Stuttgart in the morning and visited Bernhard Keimer group in MPI. The target materials of my research is copper oxides. The first paper I read after assigned to the laboratory is a review article of cuprates written by Prof. Bernhard Keimer. I would like to meet him and discuss my research topic but unfortunately he is not at the institute at that time.

Keimer group mainly uses spectroscopy in strongly correlated electron systems such as high-temperature superconductors and iridates. Most of their experiments are performed at synchrotron radiation facilities and neutron scattering facilities. I saw some synthesis machines and Raman scattering room. Thin film creating device (MBE and PLD methods) was an unprecedented one.

At night I had dinner with Dr. Ueda (former member of Tokura Lab) and Dr. Suzuki (former member of Fujimori Lab) near the Stuttgart central station. Their advice for research life is very useful and studying abroad became more attractive for me. Although it was rather short time, it is enough to increase motivation for research.



Dinner at Stuttgart

【Overall impressions】

In this trip I keenly feel the importance of English. During discussion I couldn't tell the detail of my thought, which was very frustrating. I have to brush up my English ability.

I also feel the difference between Germany and Japan. It seems that foreign researchers enjoy their research life more than Japanese. This may be related to cultural difference, but I would like to emulate their attitude.

【Acknowledgement】

I would like to thank all the professors and staffs who planed this overseas program. This experience was really an unforgettable to me. I also appreciate the staff of MPI Stuttgart, Dresden and KIT, who warmly welcomed me. Prof. Shibauchi and Dr. Mizukami gave me some advice for my visit. I will make use of this experience in research life.

MERIT Overseas Training

Department of Advanced Materials Science, M1

Tsuyoshi Omi

I visited Max-Planck-Institute Stuttgart (MPI Stuttgart) and ETH Zurich in one of the programs of MERIT course about one week. I would like to report my experience there. Thank you to my colleagues Mr. Araki and Ms. Fujishiro for visiting same laboratory and planning to do there.

【2/28 Visiting MPI Stuttgart】

The first day, we visited MPI Stuttgart by all of the students in that program. We visited various laboratories in the day, and we had the poster session with scientists in MPI Stuttgart. My ability of speaking English is poor but I could make them understood about my research gradually by discussing it until they consented it.

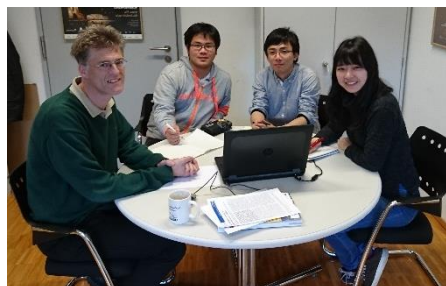
【3/1 Presentation in ETH】

The second day, I went to ETH Zurich and did presentation about my research to Prof. Manfred Fiebig, Prof. Nicola Spaldin and their laboratory members. This presentation was different from the poster session in MPI at the point that this presentation was conducted to scientists whose research topics were near to mine. And after the presentation, one-to-one discussion with laboratory members of Prof. Spaldin was also conducted. I think those presentation and discussion are good experience because my understanding to own research was tested and they gave me some nice advice at that time. The right picture was taken after the presentation. The center man is me, left man is Prof. Fiebig, right woman is Prof. Spaldin. Prof. Arima, our laboratory boss, introduced me to them and this visit was realized.



【3/2 Visiting the Experiment Facilities in ETH】

The third day, we visited the laboratory of Prof. Fiebig, and introduced us about the research contents. The right picture was taken in the room of Prof. Fiebig when the research introduction was conducted. In that laboratory, there were many experimental equipments, such as a light measurement system, a

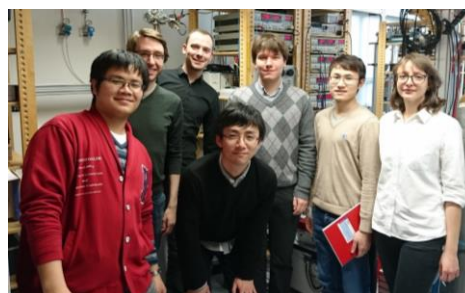


THz light measurement system, Pulsed Laser Deposition system, a polarization force microscopy, and so on. The group which researched Monte Carlo Simulation existed in that laboratory nevertheless the main topic of the laboratory is experiment. Moreover, they contacted the Prof. Spaldin's laboratory intimately, they clarified physics phenomena fast by experimental and theoretical approach. I was very impressed that one laboratory had experimental group and theory group simultaneously.

【3/3 Visiting MPI Stuttgart】

The last day, I visited Dr. Joseph Falson, our group senior. Dr. Falson taught us their equipment in detail. His laboratory has many low temperature and high magnetic field equipments. I was surprised at their having such many equipments which could occur extreme situation, for example the temperature was about 50 mK and the magnetic field was about 21 T, in one laboratory. I was conscious of the difference of the amount of the research expense to the fundamental research between Japan and German. I want to research in those laboratory which has the passion to research in the future.

Right picture was taken with Dr. Falson and same laboratory members with him. In fact, there are three magnets mentioned above in the rear to these members.



【General Comment】

This overseas training was my first trip abroad, so I felt the much difference in some point about research and the view of city from Japan. I want to admire the sophisticated experimental system to conduct experiment as accurate as possible. And I want to apply this experience to my future work.

【Acknowledgement】

Thanks to Prof. Takagi and Dr. Nakano for taking care of us in German, students in MPI for planning our visiting schedule, professor Fiebig, professor Spaldin, their secretary and their laboratory members for discussing my research and introducing their research, and Dr. Falson.

Lastly I appreciate professor Arima for introducing me about ETH and colleagues for visiting MPI and ETH together.

MERIT overseas training report

Graduate School of Frontier Sciences, Department of Advanced Materials Science,

Takeya-Okamoto Lab. Ryo Fujimoto

2/28 MPI for Solid State Physics (Stuttgart)

We visited Max Planck Institute for solid state physics and listened to introduction of some research and saw three laboratories. About their research introduction, there were some research methods, theories, equipment, and synthesis. We could see some research which had little difference from research in Japan, and other research which needed many people or the very big equipment. After that, we saw three laboratories. First was the laboratory in which they could fabricate thin films. In that laboratory, they can make films and do some measurement without air. Pumping machines were located in other room, so this room was not noisy. Second was organic synthesis laboratories. Third was the high pressure synthesis laboratory. In the laboratories, we heard the equipment which was widely used in Japan or Europe. The difference due to countries was interesting. We also presented our research with a poster. Some people came to my poster and I explained. I had a good chance to consider the question from other field researchers.

3/1 Universität Heidelberg Prof. Dr. Jana Zaumseil (Heidelberg)

I and my colleague Tatsuyuki Makita visited Prof. Jana Zaumseil laboratories at University Heidelberg and had the discussion. Her group researches charge transport of optical characteristics of organic semiconductors and carbon nanotubes. We saw some machine for fabricating carbon nanotube films, and optical measurement equipment. After the lab tour, she talked to us about the recent research. One was about polymer semiconductor optical and Raman spectrum. We discussed states of carriers in polymer semiconductors from those data. She also showed us carbon nanotubes luminescence data.

3/2 BASF (Ludwigshafen)

We visited organic transistor research group in BASF, had the presentation of our research, and discussed. In the presentation, although my research was not directly related to transistors, they got interested in my research and they gave me some advice. And I could hear the research in the company and think same points as the university (experiment machine) and different points (considering environment or manufacturing). After visiting the laboratory, we can join the bus tour of BASF factories, which is the largest plants in the world.

3/3 MPI for Polymer Research Prof. Dr. Martin Baumgarten (Mainz)

We visited Prof. Martin Baumgarten in Max Plank Institute for polymer research. His group synthesizes π -conjugated materials and we could hear the most advanced materials. We could see a lot of approach to improve mobility or efficiency of luminescence (more complicated system, including radicals, dendrimer, having the dipole etc.)

As a whole

Through the visit of laboratories and companies in Germany, I could see similar points and different points from the research I am doing in Japan. With this experience, I want to improve my English and communication skills for the next chance.

I want to say thank to MERIT, Dr. Nakano, Prof. Takagi, and laboratories I visited for kind helps.

MERIT Overseas Training Report

Department of Advanced Material Sciences, M1

Tatsuyuki Makita

This is the report on MERIT overseas training in Germany from February 27 to March 5, 2017.

1. Group Work on February 28

We visited Max-Planck-Institute for solid state research in Stuttgart. We received introductions of their research topic from each laboratory, took part in a lab tour, and gave poster presentation about our own research. I could have a precious experience through the fruitful discussion with the researchers who have different backgrounds. I could also deepen my friendship with researchers in the institute at the social gathering in the evening.

2. Individual Work from March 1 to 3

I visited laboratories and a company studying on organic semiconductor with my colleague Ryo Fujimoto during the term of individual work.

2.1. Visit to Prof. Jana Zaumseil Group on March 1

We visited Prof. Jana Zaumseil group in Heidelberg University. This group focuses on optoelectronic devices. They utilize a wide range of experimental techniques such as chemical synthesis, optical spectroscopy, and device fabrication. First, we observed their laboratories and Prof. Jana kindly gave us introduction of facilities they have. There were facilities which our group don't have. I was particularly interested in fluorescence spectroscopy and Raman microscopy and could know what kind of information we can get from these measurement. After that, Prof. Jana introduced their latest research topic to us. I could learn a lot about what I was not familiar with and broaden my horizons. She answered my questions politely. I was able to have a meaningful time there.

2.2. Visit to head office of BASF on March 2

We visited head office of BASF in Ludwigshafen. We met Dr. Jochen Brill in the morning and had a chance to introduce our research to the researchers working in the laboratory. It was pleasure for me to discuss with people who are working on topics which are similar to mine in a company and I could have a valuable experience. After that, we observed their laboratory. Although the facilities they have were not so different from ones our group have, there was a big difference in the way of thinking between research in a company and a university. They told us that they mainly focus on the processes which can be applied to mass production. We took part in the plant tour for the public in the afternoon. I could ask a lot of questions and learn a lot about the company because no one participated in the tour

except for us. First we toured the site by bus and then we learned the history, principle, and products they handle in the visitor center. There were a lot of things I was interested in. In particular, it was impressive that they place the most importance on realizing sustainable society. I thought that it is important to look ahead to the future to be one of the biggest companies in the world.

2.3. Visit to Prof. Martin Baumgarten Group on March 3

We visited Prof. Martin Baumgarten group in Max-Planck-Institute for polymer research in Mainz. We got introduction of their research topics and then observed the facilities in their laboratories. They mainly focus on design and synthesis of polymer. We had a fruitful discussion about individual research. We also had an opportunity to discuss topics other than synthesis. In particular, I could learn a lot of things through communication with the researchers who are familiar with the fabrication and investigation of organic field-effect transistor. Although they were small group, they were proud of making much progress under limited circumstances. It was very stimulating for me.

3. Summary

I had great experience although it was only a brief period of time. I could know the way of thinking of people in foreign countries. It was also a great opportunity for me to discuss my own research topic with researchers who have different backgrounds. On the other hand, I fully realized the lack of study and communication skill in English. This experience extremely motivates me to make a great effort to improve myself.

4. Acknowledgement

I am deeply grateful to professors and people related to MERIT program for planning this program. I would also like to thank professors and members of laboratories for kind hospitality.