Report of the fourth overseas training

2016/2/22～2016/2/28

Stanford University, USA

東京大学
統合物質科学リーダー養成プログラム
MERIT Materials Education program for the future leaders in Research, Industry, and Technology

Contents

Preface

This overseas training was conducted for 7 days from Feb. 22, 2016 to Feb. 28, 2016 as a part of Materials Education Program for the Future Leaders in Research, Industry and Technology (MERIT). 23 students who visited Stanford University, other universities and research institutes was chosen by "Department of Applied Physics", "Department of Electrical Engineering and Information Systems", "Department of Materials Engineering", "Department of Applied Chemistry", "Department of Chemical System Engineering", "Department of Chemistry & 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 Scineces.

We visited Stanford on Feb. 23 and observed campus of Stanford University in the morning and then we visited Professor Harold Y. Hwang from Department of Applied Physics, Professor Zhenan Bao from Department of Chemical Engineering, Associated Professor Yi Cui from Department of Material Science and Engineering. We could act by ourselves from Feb. 24 to Feb. 26. The details of these activities are written in the part of personal report.

Finally, I sincerely appreciate all the instructors including Professor Toshihiko Koseki, who is the program director, Professor Masashi Kawasaki, who is the program coordinator, Ichikawa Masakazu, who is the program chief manager and Associated Professor Toshihiro Okamoto with Special Lecturer Youhei Yamaji who are the leaders of this overseas training. Also I want to thank all the staff and students who accepted us at Stanford University. I deeply thank all the people who helped and supported this training.

All the members of this overseas training

Schedule

2/22 (Monday)
17:10 Departure from Narita International Airport
9:30 Arrival at San Francisco International Airport

2/23 (Tuesday)
9:45 Arrival at Stanford University
10:00～11:45 Campus tour
13:00～14:30 Laboratory tour of Professor Harold Y. Hwang's group, Professor Zhenan Bao's group, Associated Professor Yi Cui's group
15:00～20:00 Workshop and dinner with Stanford University Students

2/24 (Wednesday)
Individual Activities

2/25 (Thursday)
Individual Activities

2/26 (Friday)
Individual Activities

2/27 (Saturday)
11:10 Departure from San Francisco International Airport

2/28 (Sunday)
15:20 Arrival at Narita International Airport

MERIT overseas training report

Department of applied physics M1
Shinichi NISHIHAYA

In this training, we had three whole days for free activities and I visited several research groups in Stanford University and UC Berkeley.

Visit to Shen lab. and SLAC(Feb. 24th)

On the first day, we visited G.-X. Shen lab. and SLAC, a synchrotron radiation facility in the Stanford University. They mainly work on topological materials and high-T_c superconductors through direct observation of their electronic states by angle-resolved photoemission spectroscopy (ARPES). Especially when it comes to a topological material, confirming its band structure by ARPES is an essential proof for such class of materials. Since I myself is working on topological materials and also need to read ARPES paper occasionally, it was really interesting to learn about actual ARPES equipment configuration and operation related things. Moreover, as one of the most famous ARPES groups in the world, their facility was full of state-of-art equipment like 11 eV laser ARPES. We could not help being astonished when we found 2 MBE chambers and 1 PLD chamber were attached to an ARPES chamber in SLAC. That was for in-situ manipulation, keeping samples under high vacuum. Besides that, we also had a chance to take a look at their newly developed measuring method called as micro impedance microscopy (MIM). The interaction of the sample and the proving microwave gives the change in impedance signal and that in turn can map out the conducting and insulating areas of the sample in 100 nm scale. This method can be applied to imaging, for instance, domain conduction or edges channels in quantum hall states. The measurement itself is quite noise sensitive, so that it can be influenced by the outside situation like the number of people and cars going around, even though the room was isolated from any vibrations, as the guiding Ph.D. student told.

Fig. MIM in Shen lab.

Visit to Ramesh lab. (Feb. 25th)

The next day, we went to UC Berkeley and visited R. Ramesh Lab. The campus of UC Berkeley itself was unlike that of Stanford university, which was more compactly located in the middle of the downtown and more similar to the our campus in Tokyo. Ramesh group is mainly working on ferroelectricity and multi-ferroic effect using oxide thin films. Since the research topic there was very close to that of my own laboratory, the experimental facilities are not so new to me. However I

found many differences in equipment configurations from our group and it was a nice experience to compare them in detail. As one of their accomplished projects, we were introduced to their recent work on newly discovered electric polarization vortices observed in $SrTiO_3/PbTiO_3$ superlattices, which can be regarded as the ferroelectric counterpart of skyrmion order in magnetics. We also had a talk about student lives in UC Berkeley with a graduate student and a postdoctoral researcher in their group. They told us that their group was sharing facilities with other two research groups and regularly holding joint seminars, which made me impressed with their open attitude for inter-lab cooperation.

Fig. PLD chamber in Ramesh lab.

Visit to Vishwanath lab. (Feb. 26th)

On the last day, I went to UC Berkeley again to visit professor Vishwanath and their group members, doing research on topological materials theoretically. Especially, they have published lots of papers on Weyl semimetals and Dirac semimetals, which unfortunately have not been so intensively studied in Japan. As one working on that topic experimentally, it was really meaningful for me to have a discussion with the professor in person and his students, comparing my experimental data and their published results. At first, I was a little bit nervous about whether I could properly discuss physics with theorists, but their unexpectedly welcome attitude made me feel at home and we could have a fruitful discussion, extending to the possible future directions in my research topic. In the middle of our discussion, several graduate students attending the professor's course came to meet him and asked questions about his lecture content. It was impressive to see that they never stopped asking unless they fully understood from the very basis. We also talked having lunch together about how experiments are usually done in my laboratory and found their interests and understanding also in experiments. In the building where their laboratory was in, I could see blackboards everywhere, like one in every five meters, and the students there can dedicate themselves to discussions whenever and wherever they like. That is the place where they build up their competence and high expertise.

Others

During the campus tour with other MERIT students in Stanford University, I was overwhelmed with the extraordinarily large scale of the prestigious university in the U.S. I had heard of that the amount donation from the graduates was huge, but it was well beyond my expectation. It even made me feel like there is no chance for Japanese universities to get ahead of it. We are also told that in some case university side bought expensive, up-to-date machines and let the research groups use

them, though taking money every time. Since there are engineers in charge of each equipment, students can also concentrate on their own work without consuming time for any equipment maintenance, which was impressive to me.

I also want to mention that I met a lot of Asian people studying in Ph.D. course during the visits. I could ask some of them how and why they decided to come to America. To my surprise, they took it almost as a matter of fact to study abroad and did not feel any barrier for it. What is more, they are coming to America with firm objectives. This aspect leads to their very high motivation and hard work. Recognizing who I need to compete with in the near future gave me a higher incentive to work hard. I must not forget what I saw and felt during this training.

Acknowledgement

I would like to thank all the MERIT professors and staffs involved for organizing this kind of fruitful opportunity. I also want to express my gratitude to Yamaji-sensei and Okamoto-sensei for leading us in the training, and members in each laboratory for warm welcome.

Report of MERIT's overseas training

Department of Applied Physics
Masataka Mogi

I would like to report my experience during three days of this overseas training. In the three days, I independently visited Zhi-Xun Shen's group, Shou-Cheng Zhang's group and David Goldharber-Gordon's group at Stanford University. These groups specialize in 'topological insulator' as one of main themes. The aims of the visits are (1) to have exposure to a research-environment in foreign country through deep discussions and (2) to get to be known my face and make new friends in foreign countries by giving a talk of my recent research as a seminar. These seminar and visits could be realized by introduction from Dr. Yong-Tao Cui and Mr. Eric Yue Ma at Shen group at Shen group. I would like to thank them. The seminar at McCullough in Stanford University is the most impressive and valuable experience during this overseas training. About 30~40 people from several group majoring physics come to hear my seminar. I have talked about 1 hour containing discussion time and I think it was succeeded. From a lot of questions for my research, they are very interested in my research.After the seminar I discussed with Dr. Cui and Mr. Ma in more detail.

At Zhang group, I met Dr. Jing Wang. We discussed about my seminar from the theoretical point of view and future research for topological insulator. We exchanged my e-mail address and decided to keep in touch in the future.

At Goldhaber-Gordon group, I talked with Prof. David Goldharber-Gordon,

Mr. Eli Fox and Mr. Aaron Sharpe. They showed me their recent results and we did a substantial discussion. Additionally, a possibility of collaboration was borne out.

At the night of the final day, Dr. Cui and Mr. Ma invited me and Dr. Yamaji (a leader of this MERIT overseas training) for dinner. One of the impressive talk which they give is 'Research is interaction with others'. They have a lot of communication with collaborators of their research. They eagerly discuss with them. I want to learn their postures.

Finally, the three days gave me a valuable experience to understand the forefront of research in the world. I want to thank all staffs of MERIT program, Tokura laboratory to which I belong and Prof. Tokura. I want this gratitude return as improvement myself through MERIT program and research results.

MERIT Overseas Training Report

Mishchenko Petr
Graduate School of Engineering Department of Applied Physics (Motome Laboratory)

During one week from 22nd to 28th of February, as MERIT overseas training program, I had an opportunity of visiting Stanford University and University of California Berkeley in the United States of America. Both universities are world-famous for the high level of education and research, and hence, visiting them was a great experience for me. In the following report I am going to tell about my activities during the overseas training.

[Stanford University, 23rd of February] (Group Activities)

This day we moved altogether as MERIT group and participated in several activities like campus tour, laboratories tour, discussion and party with Stanford University students. During this day we could learn a lot about life and research style in the United States and spend really fulfilled time.

In the campus tour we could notice that research atmosphere in Stanford University is really opened. We could feel it in such things as glassed-in discussion rooms which were placed all around the campus, and also in glassed-in laboratories.

After the campus tour all of us visited three laboratories which are Harold Y. Hwang laboratory, Zhenan Bao laboratory, Yi Cui laboratory, and during laboratories tour I could feel not only the opened style of research but also high motivation of students. Especially interesting was the method of operation of experimental machines in Stanford University. University itself owns a great number of experimental equipment, which enables all the laboratories to use them as common facilities. We were told a lot of benefits of such management scheme. For example, in case of troubles the special staff managing each machine can quickly repair the equipment, operation expenses as well as the time of maintenance can be saved, and researchers can concentrate only on research.

Next was the discussion and party with Stanford University students. Here I could greatly contribute to the smooth communication by introducing the life in The University of Tokyo by presentation. During the discussion we could learn more about the life and research in the US. I was impressed by the fact that almost all students share living facility with each other.

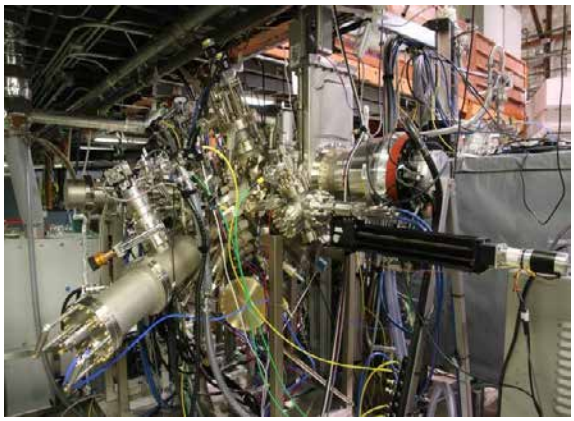
Discussion with students (I introduced the life in The University of Tokyo, representing the MERIT course students)

[Visit to Zhi-Xun Shen Lab., SLAC, 24th of February] (Individual Activities)

On the first day of individual activities I was around the Stanford University and visited the Zhi-Xun Shen laboratory and SLAC National Accelerator Laboratory. This laboratory mainly studies high temperature superconductors and topological materials by using a great number of experimental techniques. This time we could see such experimental machines as ARPES, time-resolved ARPES and MIM.

①ARPES: First of all we went to SLAC National Accelerator Laboratory and looked at ARPES which is especially suitable for studying of electron structure and band structure of thin films. There were two ARPES machines, Beamline 5-4 and Beamline 5-2, and Beamline 5-2 was especially interesting for me. This experimental machine was a combination of 2 MBEs and 1 PLD, which are used for making thin films,

Beamline 5-2

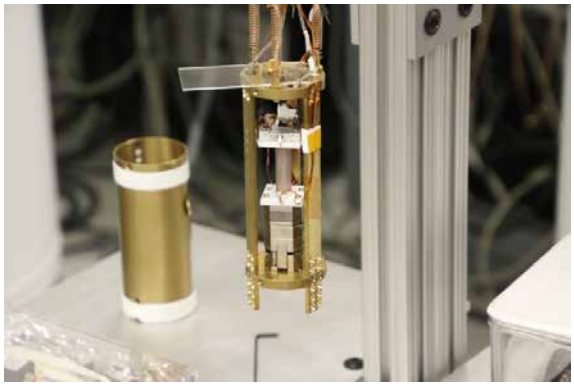


with ARPES and 3D spin detector. This machine is especially suitable for experiments in high vacuum. Surprisingly there was another space for attaching some more deposition systems.

②time-resolved ARPES: After SLAC National Accelerator Laboratory we went to the Zhi-Xun Shen laboratory inside the Stanford University campus and could see time-resolved ARPES machine. As time-resolved ARPES can measure non-equilibrium states, it recently became an experimental tool widely used in studying of strongly correlated systems. Principle of time-resolved ARPES is follows. First, infrared laser excites system (pump) and after a small time UV pulse observes its state (probe). For me time-resolved ARPES machine looked like small version of ARPES machine. The only difference I could see was in optical system which connected laser and experimental machine. Compared to laboratories studying optics the structure of optical system was not so complicated.

③MIM: The last experimental machine we could see was MIM (Microwave Impedance Microscopy) machine. In this experimental technique with the help of microwave applied to the compound one can observe spatial change of conductance by local change of impedance with 100nm resolution. Domain structure of strongly correlated structure, phase separated compounds and biological compounds are studied using this experimental technique. A student using this technique in his research told us that MIM is extremely susceptible to oscillations. In spite of seismic base isolation system of building and underground laboratory he can only believe results obtained in the weekend when there is no any people walking around.

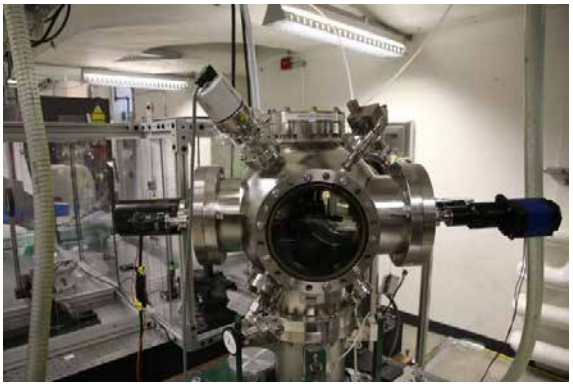
MIM machine



[Visit to Ramamoorthy Ramesh Lab., 25th of February] (Individual Activities)

On the second day of individual activity we went to the Ramamoorthy Ramesh laboratory in the University of California Berkeley. This laboratory mainly studies oxide thin films and for this purpose use well known PLD machine for growing thin films. Jeremy Turcaud led us through the laboratory and explained structure, maintenance, experiment and operation procedure of this machine. After I explained that only me in our group is from theoretical laboratory, he showed me PLD machine in operation and applied laser to the compound.

PLD machine



Compared to Stanford University there were few experimental machines which are managed by the university in University of California Berkeley. Each laboratory possesses almost all equipment needed for research. In case of Ramamoorthy Ramesh laboratory machines are used by 3 cooperating laboratories. Also these laboratories carry out seminars together, which tells us that research style in University of California Berkeley is opened like in case of Stanford University.

[Visit to Yuri Suzuki Lab., Thomas Devereaux Lab., 26th of February] (Individual Activities)

On the last day of overseas training I returned to Stanford University and visited Yuri Suzuki laboratory with some MERIT students. Then I went to Thomas Devereaux laboratory alone.

First was Yuri Suzuki laboratory where functionalities of thin films and hetero structures are mainly studied. During the laboratory tour Professor Yuri Suzuki showed us equipment and then we had discussion about recent research done in this laboratory. In the laboratory we could see PLD machines common for the laboratories studying thin films. I am not a professional in that field so for me all PLDs looked the same structure with ones we already saw in Ramamoorthy Ramesh laboratory. Stanford University doesn't have facility to restore liquid helium so many laboratories doing low temperature experiments are suffering from that fact. In this laboratory, however, I was impressed by number of new machines which reuse liquid helium.

Next I went to Thomas Devereaux laboratory. During this overseas training it was the only theoretical laboratory. This laboratory studies strongly correlated physics and uses different calculation techniques for it. This time with the help of Brian Moritz, a researcher from Thomas Devereaux laboratory, I had an opportunity to discuss with research group using determinant Monte Carlo method. I had a chance to talk about my research and received a lot of suggestions like calculation of new observables which I was not considering at all. In addition I was asked some questions about the Monte Carlo implementation in my case and answering to this question I could understand some parts of my research too. After that I could hear about the research in Thomas Devereaux laboratory. The information about a possible application of the determinant Monte Carlo technique to my problem was very helpful.

[Some comments on all individual activities, from 24th to 26th of February]

During this MERIT overseas training program my purpose was not only improving of my English but also improving of my knowledge in experimental physics. This time I had to overcome a lot of difficulties with understanding of experimental physics. In process I could understand that there is no any problem with communication in English and also I could get enormous knowledge in this field. Thus I have achieved both purposes.

In addition during this overseas training I was impressed by the fact that students from both Stanford University and University of California Berkeley were good not only at explaining their research to people who are not specialists in their research field, but also in understanding of other researches. I thought that this ability probably naturally comes from enormous time of discussion they do.

Acknowledgement

I thank the professors and all staffs of the MERIT program for planning this overseas training, Dr. Okamoto and Dr. Yamaji for leading us through this trip. Also I would like to thank all the staffs and students who accepted us during this trip to the Stanford University and University of California Berkeley. This overseas training could be held only with the support of all them. Thank you very much.

Electornic engineering Master 1st year Yoon Sanghee

I went to Tsu-Jae King Liu Lab which is in the UC Berkeley all of three days. In case of electronical engineering department, lab don't want to show their lab because of security. So, I got a student address who has relationship with our professor, so I can have many opportunities to meet Tsu-Jae King Liu Lab's students and attend some seminars.

[2016/2/24 Tsu-Jae King Liu lab(UC Berkely)]

On first day, I met a student name of Kato, whom my professor introduced and I met some students in Tsu-Jae King lab. Professor King Lab is now studying on Micro/Nano Electro Mechanical System(MEMS) and integrated circuit, and it is little different from my research. In our lab, I am studying on high performance of transistor but Professor King lab is studying on making circuit with high performance of transistor. So I was worried about meeting people of professor King Lab. And there was Japanese researchers seminar from 6 o'clock.

At first, I met Kato. Actually, I thought visiting lab is impossible so I almost gave up visiting some lab. And I was so pleased to contact with Kato. He introduced some seminars in 24-26th, and made me meet some students.

And this is the picture of meeting some students of professors king lab name of Robin. We introduced our research respectively and talk about some research. And I met some students from Taiwan, China, Korea. And I was impressed about their way of studying. In case of Japan, project of lab is almost confirmed and we have to choose our research title from what our professor suggestion. But in case of America they determine their theme themselves. So they have pride with their research theme. I think this mind should be emulated.

Next, I attend Japanese researchers seminar. Seminar contents were automobile engine control technology and bio-verification technology. My

research don’t have relation with these theme, but I was interested in bio-verification so I was glad to hear some presentation about this. But this seminar started at 6 o’clock, so I had to leave this seminar early to come back to hotel.

[2016/2/25 Tsu-Jae King Liu lab(UC Berkely)]

On second day, I heard seminar that has relation with TFETS interface properties which is relative to my research and I had clean room tour of UC Berkeley.

At first, I heard seminar that has relation with TFETS interface properties which is relative to my research. Especially, flow of presentation was impressive. Usually, presentation starts with introduction and data is given and make some conclusion. But in America, there was no hard flow of presentation so many ideas of each data can be deducted in the presentation. I was so surprised about this. And with this seminar, I looked back on my research.

And next, I visit the UC Berkeley clean room. I heard that UC Berkeley clean room is so big compared to other university. I changed my clothes to clean suits and entered to clean room. And I thought it will be so good if I can have experiment in this clean room because of big and high quality of machine. Picture of right side is clean suits of UC Berkeley clean room.

[2016/2/26 Tsu-Jae King Liu lab(UC Berkely)]

I had a chance to talk with professor Tsu-Jae King. She was so kind and she gave me a lot of advices. So, I thought that it would be so glad if I can had a chance to have a collaboration with her lab.

And next, I met a friend of Kato. Actually, I especially request to kato to meet his friend. His friend is now studying on bio-devices. And I am studying on devices but in future, I want to make a research on bio-devices,

too. So now I am agonizing about changing the laboratory. His friend also studied on devices and changed his lab to study bio-devices. His friend gave me a lot of devices and I made the decision whether to change the laboratory or not.

[Totally]

In case of electronical engineering department, lab don't want to show their lab because of security. So I suffered from making schedule of overseas training. And I think it would be wasting time if I didn't take a contact with Kato so I am so appreciate to him. Actually, I set target of overseas training to learn UC Berkeley student mind. As a result I accomplished my goal of overseas training and I was glad to go America.

Report for Feb. 22nd -28th, 2016, Stanford University

楊皓月 37-145032

I am a student coming from China. I chose Japan to take further study because I respect Japanese dealing things so seriously which I believe will give amazing effect in scientific research.

But with further study in Japan, recently I realize it is still important to practice English ability even my research is in Japan. Because in present science world, worldwide language is English. We need use English get new information and need publish our result in English.

Before I came Japan for further study, I have never stay in English circumstance for scientific study. Though I might be used of daily English, for deeper research, I wish I could have experience to communicate with native English science researcher to get used to scientific English. After arrived the US on Feb 22nd, 2016, my academic tour was as followed:

23rd, all participated in this special course went to 3 labs together, including Hwang Gr., Bao Gr., Cui Gr., SMF, SNC. As actually they belong to different research department and area, we had a brief view of their lab and then mainly exchange life and research with students from these labs.

24th, from this day are all planned by individual students and as for more field outlook, I went to a public class from Stanford University Business School which gave by a CEO of clothes company. She is an independent woman and share her experience how to make progress in work.

25th, I went to Zare Lab, as they have similar research as mine. Mine is molecular imprinted polymer (MIP) and they have research on cell imprinted polymer (CIP). They introduced their research and we talked about the problem I faced now. But as they have more experience on this research, they could quickly gave advice to what I concerned. Which made me to push myself work harder.

26th, the third day I made a Google Co. tour. I heard from a lot of people Google has top working condition in the world, even from Stanford people. After I arrived there I found the reason attracting people as water pool and game room. What made me interested in is how this big company make profits. After the tour, I know that most of money Google made is from advertising department. Which help send and put advertisement on all of the media connected to Internet. Not only on web page, but also like on the smart phone game. They linked every small parts where we could see and advertisement company to put advertisement on. Depends on the large population, every glimpse or touch from us made them money.

During this event, I tried to think and study in academic English and made connection of my research in Japan and the research in Stanford University.

I precious this chance to visit Stanford University very much as it is top university in the world and by this environment new idea raised up and helped with my academic English

expression.

Dept. of Applied Chemistry, Hashimoto laboratory
Masahiro Kaneko

I visited 6 laboratory during Feb. 24th to Feb. 26th. First day, I visited Waymouth lab, Xia lab and Dai lab in Stanford University. Second day, I visited Savage lab in UC Berkeley and Ajo-Flanklin lab in Molecular Foundry, Lawrence Berkeley National Laboratory. Third day, I visited Chang lab in UC Berkeley. I'd like to report about Waymouth lab, Xia lab, Dai lab and Ajo-Flanklin lab.

【Waymouth lab, Xia lab and Dai lab】

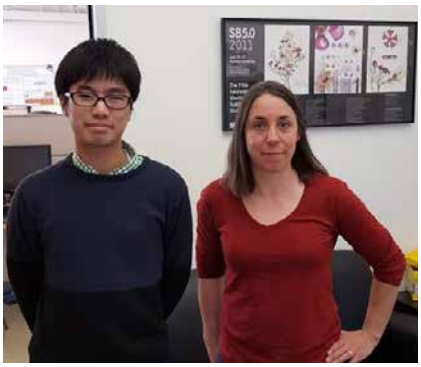
A picture with the members of Waymouth laboratory

I visited Waymouth lab, Xia lab and Dai lab with Ueda-kun, Kawano-san and Yatabe-kun. A doctor student in Waymouth lab kindly organized the lab tour of the three laboratories. One thing I surprised was there was a faculty which sold main organic solvents and chemical apparatus in Stanford University, and researchers could buy them soon. In usual case, we should order them and wait for several days. Therefore, I thought it was very useful and if there were such faculty in The University of Tokyo, our researches would be enhanced to some extent. Also, we attended a meeting of Waymouth laboratory. In the meeting we introduced each research briefly after a person in Waymouth laboratory talked about his research progress. In that progress report, he talked about a bioplastic, PHA (polyhydroxyalkanoates) synthesis by using methane oxidizing bacteria. Namely, his research was a mixture of organic chemistry and biological chemistry. He synthesized monomers of PHA and polymerized the monomers by utilizing the metabolism of methane oxidizing bacteria. I could follow his talk since I had some relative knowledge. In my laboratory, the electrochemical enhancement of PHA production by using transmembrane redox-active polymer was previously achieved. After his talk I could have an opportunity to discuss research topics, such as electron injection to methane oxidizing bacteria which was one of my research topic.

【Ajo-Flanklin lab】

In Ajo-Flanklin laboratory, interfaces between living microbes and non-living materials are studied. I'm now studying about extracellular electron transfer through

transmembrane redox-active polymers. Therefore, especially I was interested in a research about extracellular electron transfer by using *E. coli* which was introduced outer membrane cytochrome of *Shewannella oneidensis* MR1 and I decided to visit this laboratory. In my research, diffusive electron mediators are used to enable general microbes to conduct extracellular electron transfer. On the other hand, in Ajo- Flanklin laboratory, an introduction of conductive protein is a method to achieve extracellular electron transfer in general microbes. So I wanted to how different the way of thinking about the research topics. I took appointment by e-mail. She kindly allowed me to visit her laboratory. Moreover, I got a chance to introduce my research in the front of the members of her laboratory. For the research introduction, though I prepared slides to talk for about 30 minutes, it took over an hour because there were a lot of questions during my talk. After my presentation, I received some valuable comments. Also, she kindly told me that I could research in her laboratory for several months if I wanted to do. Molecular foundry is opened to all researchers and the members can use many kinds of cutting-edge equipment. Thus, I could get a promising candidate for a long term oversea training, one of the MERIT course works.



A picture with Dr.Ajo-Flanklin

At last, I would like to thank professors who planed this program, MERIT staff members, Prof. Okamoto and Prof.Yamaji who led us in this training and all members in laboratories I visited. Thanks to their support, I had a very meaningful time without getting involved in trouble. I am deeply grateful to them.

MERIT Overseas Training Report

Applied Chemistry Mizuno Lab. M1 Yatabe Takafumi

I participated in the overseas training mainly at Stanford University from 2016/2/22 to 2/28. The week was full of various experiences, and I'll report particularly impressive ones.

1. Visit to Waymouth group

On 2/24, I asked Mr. Ueda and Ms. Kawano, MERIT students from Aida group, to go together to Waymouth group, Xia group, and Dai group they had already made appointments with. I'll mention the experience in Waymouth group which welcomed us as host group.

In Waymouth lab. Ms. Xiangyi Zhang in the doctorial course introduced their researches and guided around the laboratory. In addition, we were able to take part in the seminar of Waymouth lab. and made our own presentations respectively for 15–20 minutes after listening to the presentation of Mr. James C.A. Flanagan.

First of all, we were surprised to hear all rooms belong to Waymouth group on one floor. Indeed, each person has one draft and one desk in the experimental room, and the space is sufficient (Figure 1) compared with the space of Mizuno laboratory which is very narrow to pass for only one person. In the University of Tokyo, each laboratory basically has its own analytical equipment. For example, on a floor Mizuno group has two NMRs, twelve GCs, two instruments for single crystal X-ray structure analysis, FT-IR, UV-Vis, XRD and so on. Therefore, available space in the laboratory is limited. However, in Stanford University almost all of the above-mentioned instruments are used in public and installed on different places, which contributes to the sufficient space in a laboratory. It is hard to determine which one is better, but I felt it attractive that the existence of engineers for respective common instruments omitted much time which students spent dealing with trouble for instruments and they could concentrate on their own research about chemistry. However, in foreign countries students should spend much more time taking classes and working as TA or RA than in Japan. Considering overall, students in Japan can use instruments without reservation and it is easier to nourish the ability to complete their own research by themselves.

Another point I was surprised at in Waymouth group is that all of the research themes are related with each other from basic contents to applied ones. The story was very impressive to me individually that the beginning basic content was kinetics analysis of selective oxidation for polyols with Pd and ring open polymerization with organocatalysts was done using substrates synthesized by the selective oxidation to produce functional polymers because it is possible to learn various things from basis to application and contribute to societies easily and I can feel the beauty of chemistry. This is also because I feel in daily lives that the wide research field of Mizuno group I belong to causes little relation with the respective themes. In the future, if I continue on educating and studying in universities, I want to do consistent researches including various fields.

Figure 1. Experimental room of Waymouth group.

Additionally, it was very precious experience that we were able to join in the seminar of Waymouth group. In daily lives I have no chances of using English, so it was the first time for me to join the English seminar and make a presentation in English. There were many bad points including my poor English abilities, but I'll try to make them

better from now on. The good seminar also played a role for teaching me the other research field because it was not close to my research theme.

Finally, we took a picture with people of Waymouth group (Figure 2). I appreciate all people of Waymouth group accepting us comfortably, including Ms. Xiangyi guiding us intimately all the day.

Figure 2. Photo with Waymouth group members.

2. Visit to Cargnello group

On 2/25 I visited Cargnello laboratory I was able to made sole appointment with by myself. Dr. Cargnello is now an assistant professor who achieved great results about creation for novel nanomaterials. Their research field is different from a present research of mine, but I want to learn tuning methods for bimetallic catalysts on which I will do research in the future and I decided to make an appointment. When I met with him in fact, we introduced our own researches with each other and made a discussion. Moreover, he guided me around his laboratory.

First, to my surprise, this laboratory also has a large space in the beautiful experimental room, even though it has been less than two years since this building was constructed (Figure 3). The laboratory belongs to school of chemical engineering, so the themes of their researches are always designed under consideration for industrial use.

In particular, they aim at the research which has a big scale and influences a lot of people. My research is the development of solid catalysts for organic synthesis which is useful and possible to be widely used, but it has to be used for fine chemical synthesis to have a little influence compared with bulk chemicals. Therefore, I recognized again the great importance of researches on changing the basis of chemical engineering such as synthesis of ammonium from hydrogen and nitrogen Cargnello group is trying. However, he made a comment of finding application for organic synthesis important though he did not intend to apply to the field in his laboratory. In Mizuno laboratory, the less precise control for materials is done than in Cargnello laboratory, so the cooperation with each other will create novel potential for organic synthesis by heterogeneous catalysts.

Figure 3. Experimental room of Cargnello group.

3. Summary

This overseas training was great to touch with a lot of various researches other than my research field and to reconsider the future objective or plan in my research life. In addition, it had me consider deeply the problems of education in universities of Japan in relation to Japanese laboratories (I reported the problems when I visited MIT in the third year through M-Skype, the program in school of engineering).

Thank you so much for providing us such a great opportunity.

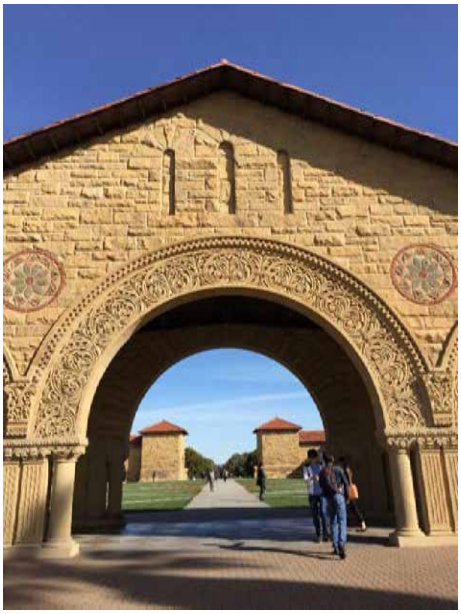
MERIT Overseas Training

Department of Chemical System Engineering, M2

MA Jiangtao

This February I visited California with other MERIT students. From San Francisco to Los Angeles, from Stanford University to University of Santa Barbara, I experienced and learnt a lot. It was my first time visiting the USA and certainly it would be an unforgettable memory in my life.

/Stanford/



The first station in California is Stanford University. We visited several laboratories including Prof. Zhenan Bao' and Prof. Harold Y. Hwang's. Stanford is quite a big university and as a result, the buildings seem to be shorter but larger. Although they belong to different departments, all the buildings we visited exhibit comfortable and efficient working environments. It is very interesting that there are many study lounges for students to discuss and study. Prof. Bao's group was doing the research about inorganic materials which was similar to our lab. Thus, the visit to her laboratory impressed me a lot and broadened my horizons about how to organize an inorganic laboratory well. As far as I'm concerned, one of the biggest differences between research labs in Stanford and Todai was the ownership of research equipment. Usually in Todai, each lab has its own equipment and seldom share with other laboratories. In contrast, in Stanford, many equipment are shared between laboratories, even between different universities. In my opinion, this phenomenon is strongly related with culture. The conservative nature of Japanese forces the labs to focus more on their own research while in USA, cooperation is more appreciated.

After visiting the labs, we had dinner with Stanford graduate students and faculty. In the meantime, Prof. Hwang gave us an impressive introduction about his research and life experiences. Of course, we introduced Todai to the Stanford graduate students. It was a nice experience to discuss academic issues with many contemporaries from different academic and culture backgrounds. Enjoying beer and pizza, we had a detailed discussion about what our future would be like in 10 years and how we could achieve such goals.

/TESLA Motors and other companies in Silicon Valley/

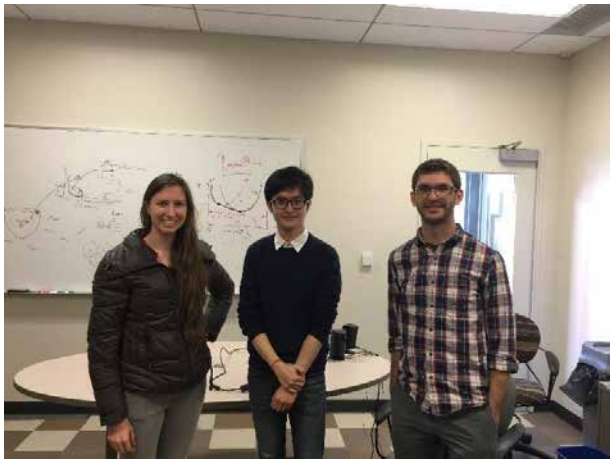
Stanford is famous for its strong relationship with many first-class companies in Silicon Valley such as Hewlett Packard (HP) and Google. Thus, in the second day, I visited many world-famous companies with the guide of Wang san, who is an engineer working in Silicon Valley.

The principal objective of MERIT program is to shape outstanding students into leaders with holistic perspectives and strong creative skills who are able to work in leadership roles in industrial, academic, and governmental sectors throughout the world. This was also the reason why I visited the companies in Silicon Valley which would definitely help me have a better understanding of industry. Under the guide of WANG san, I visited the headquarters of several companies such as TESLA, FACEBOOK, APPLE and GOOGLE. All the companies are large and attractive to employees. The corporate welfare of these companies are really nice as I can see many free shuttle buses to take the workers come and leave all the time. Another amazing thing is that the working environments are comfortable and wonderful. We can see green trees, chairs and sculptures everywhere. Also the restaurants and recreation facilities help people have a good relax.

Nowadays TELSA was quite popular among the world due to its ecological but cute

design. Electric vehicles are helpful to solve the energy and environmental problems in the world. I am doing the research of Li/Na-ion batteries which were one of the most important parts in electric vehicles. Thus, companies like TESLA or NISSAN are attractive to me if I want to work in industry after graduation. The visit to TESLA gave me a clear picture about what the life would be like if I became an employee.

/University of Santa Barbara/



The last place I visited was the University of Santa Barbara. I visited Prof. Anton Van der Ven's group with Morikawa san. Prof. Anton Van der Ven's research seeks to develop first-principles descriptions of non-equilibrium process in the solid state with a particular goal of generating an understanding of the mechanisms of phase transformations that couple diffusion and structural changes. They study a wide range of materials or energy storage and conversion devices. Computational materials science plays a vital role in revealing the mechanism of materials and seeking novel materials. However, I wasn't familiar with this field. Thus I visited this group for the purpose of having a better understanding of calculation.

Indeed, we really had a pleasant discussion. Firstly I gave a brief introduction about my research in the layered oxides for Na-ion batteries as the cathode materials. They were quite interested in this topic and raised many questions. In the meantime, they gave some helpful comment about my research. Also, they showed their research to us and explained how they operated the calculations. Thanks to their help, I understood the calculation better. Also they talked about the campus life in UCSB in which we were quite interested. The cultures of the USA, Japanese and Chinese were quite different. Nevertheless, we made good friends and learnt a lot from each other.

/Overall impressions/

This was really an unforgettable trip to me and here I want to talk about some ideas about the overseas training.

The importance of English. I think everyone knows the importance of English. Without this language ability, we even cannot start our scientific research. In my opinion, most of the MERIT students are good at reading and writing, however, the speaking and listening abilities are far from satisfactory. With hard working, we may get excellent research results. But without good language ability, we could not transfer our research data into a good story.

The importance of communication and cooperation. *Two heads are always better than one.* After discussion with students in Stanford and UCSB, I learnt a lot and even had some new ideas about my research. It is a shock to me to feel the campus culture of Stanford. All the students are willing to sit together and have a brainstorm. The more they discuss, the more they harvest. Thanks to the MERIT program, I could meet so many outstanding contemporary and even has a chance to cooperate with each other.

/Acknowledgement/

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. Yamaji and Prof. Tokamoto helped us a lot during our stay in the USA. Also I would to express my honorable thanks to Prof. Bao, Prof. Hwang, Prof. Van der Ven, WANG san and all the other people I met in the USA. Without their hospitality, this trip could be nothing but sightseeing. 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.

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Department of Chemical System Engineering
Yusuke Morikawa

I participated in the oversea training of MERIT program from Feb. 22nd to Feb. 28th. I visited Stanford University, Tesla Motors and University of California, Santa Barbara. Here I report details of trainings and the things what I learned from this training.

Stanford University (Feb. 22nd – 23rd)

We visited Stanford University for the first two days.

On the first day, we took a walk in campus. I was surprised at the area of university. The students were moved by bicycle, skateboard or bus. The bus is available free of charge for everyone. It was very useful.

We toured the campus on the second day. There are a lot of building built by funds from contribution and various kinds of analytical instruments such as SEM, XRD and TEM. According to a guide, everyone who belong to Stanford University can use all equipment basically. After that we discussed with students of Stanford. The theme pf discussion was “Can you imagine life in 10 years?” It was very difficult to argue in English. We talked a variety of things while eating dinner.

Tesla Motors (Feb. 24th)

We visited Tesla motors on the third day. I was interested in the performance of the battery because I had studied the battery. According to a staff, battery can be charged at the rate of 93 km per hour of charge and the cost of charge is $3 per 100km. I thought that it takes a long time to charge. It is essential to

develop battery that is able to charge very quickly. If we use Tesla supercharger, we can charge half the battery in as little as 20 minutes. I'm looking forward to future development.

University of California, Santa Barbara (UCSB) (Feb. 25th - 26th)

I moved from San Francisco to Santa Barbara. I visited to UCSB. Dr. Shuji Nakamura who won the Nobel Prize in Physics has served as a professor at the UCSB. The university is very close to the sea. We can see the sea if we walk from campus for 30 seconds (picture on the right). The sea was very beautiful. I visited Anton Van der Ven group. They have studied the battery by using the first-principles calculation. Unfortunately, Prof. Anton attended an academic meeting. However I was able to discuss with Dr. Maxwell and Ms. Julija. We could very meaningful discussion. We talked not only about study but also about college life and the presidential election. I ate lunch with Prof. Venkat who visited Van der Van group on the same day.

What I learned from this training

Thorough this training, there were a lot of things I didn't understand because this was the first time for me to go abroad. Thanks to the teachers and Mr. Ma, it was very meaningful oversea training. Research facilities of American universities was very fulfilling. I realized the significance of going abroad to study. It was very difficult to convey accurately the things in English that I want to say.

Acknowledgements

I am deeply grateful to Dr. Okamoto, Dr. Yamaji and all MERIT staffs. I also appreciate Dr. Zhao, Prof. Anton and Prof. Yamada. Thank you for giving us a precious opportunity.

Department of Chemistry and Biotechnology Michihisa UEDA

I visited Stanford Univ. and UC Berkeley in the MERIT overseas training program, and I had an incentive experience through the program. My activities are as follows.

2/23 (Tue.) Campus Tour and Workshop at Stanford Univ.

On the first day, all of us joined Stanford campus tour and group discussion with Stanford students. I was really surprised at the huge campus of Stanford, and also at a number of the buildings whose construction fees were donated by famous people because it is not common case in Japan. We visited the new buildings at department of engineering for lab tours. I felt that the variety or number of experimental instruments is almost comparable to Univ. of Tokyo, but it was quite different that they have many common instruments and all of them are managed by full-time technicians. The facilities such as meeting spaces on corridors, kitchen rooms, etc., which are installed for promoting communication among researchers, were also impressive. In the workshop with Stanford students, very broad discussion topic (like "the future of science and technology") confused us a bit, but we enjoyed it by expressing our own opinions of automatic driving systems and artificial intelligence.

2/24 (Wed.) Visit Stanford Univ.

On the day 2, I visited three research groups in Stanford Univ. with three MERIT members (Mr. Kneko, Mr. Yatabe and Ms. Kawano)

- Yan Xia Group

Firstly, we visited Yan Xia group. Their main research topics are investigation of controlled polymer sequences and novel polymers, and three PhD 3rd year students, who are the first generations of Xia group, kindly introduced their projects to us. They were very interesting, and they also talked about some intriguing on-going projects through the discussion. We had a great time although it was just one and a half hours meeting.

- Hongjie Dai Group

Unfortunately, Prof Dai was absent because of meetings, but Mr. Uno, who is a posdoc from Japanese chemical company, kindly guided us around the laboratory and some common rooms of chemistry department. Dai group has various research projects from carbon materials to bio probes, and it was surprising that they have many kinds of their own experimental instruments, not common machines.

- Robert Waymouth Group

Prof. Waymouth was absent at that time, but he allowed us to attend the group meeting, which all the members joined. In the meeting, a PhD 5th year student kindly told us all his research projects so far. Then, we talked about our research projects and discussed with them. After the meeting, Ms. Zhang, who is a PhD 4th year student, guided us around the campus, and then briefly told us all the projects conducted in Waymouth group.

Group photo with Waymouth group students

2/25 (Thu.) Visit UC Berkeley

On the day 3, I visited UC Berkeley with Ms. Kawano. In the morning, we visited Chris Chang group, and had a lab tour. After that, Izaac and Shawn, who are students in Ting Xu group, guided us around not only the campus but also the student quarter for more than three hours. UC Berkeley has really beautiful classic campus, thus I was excited to walk inside of all the buildings. Also, taking a long walk with catting with same generation's students was very enjoyable for me more than expected.

Ms. Kawano (left), me, and Izaac (right)

2/26 (Fri.) Visit UC Berkeley

On day 4, I visited some research groups in UC Berkeley with Ms. Kawano.

- Matt Francis Group

In the morning, we joined a sub group meeting in Francis group. That sub group conducts DDS projects with peptide motifs, and the meeting was very active so that anyone can comment on the presentation anytime. The topic is not close to our background, but they answered my questions with understandable words for us, thus we had a fruitful time. Three sub groups in Francis group have a meeting with the professor every Friday, and I thought that it should promote interactions among all the members.

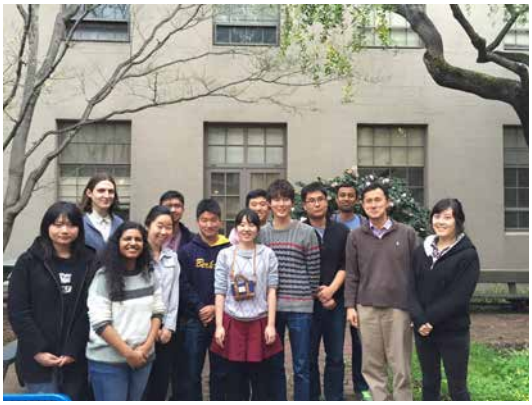
- Brett Helms Group

After taking lunch, we visit Helms group in the Molecular Foundry. The Molecular Foundry is a national research institute, so the air was different from the university. When we waited for Dr. Helms, one of his students, Stephen, kindly guided us around the building. In each lab room, they have many

brand-new instruments, and I was surprised at automatic single crystal generator and analyzer, whose size is almost a small room in Japan. They said that new machines are often installed, and I felt that that is the forefront research institute. Dr. Helms told us about the project of fuel cells with supramolecular chemistry. It was impressive that they factorize topics into elements that chemistry can improve, and then designed the molecules for solving the problem.

- Seung-Wuk Lee Group

Finally, we visit Lee group. Prof. Lee was the host of our UC Berkeley visit. We attended the group meeting, and they talked about very interesting projects. That was investigation of Apps for high-sensitive gas detection system by bioengineering method. The projects were conducted by students whose backgrounds and skills are totally different from each other, like bioengineering, mechanical engineering, and information science. Interdisciplinary research for commercial application itself is very impressive to me, and the fact that it is conducted in a university also inspired me a lot. After the meeting, Prof. Lee took us to a Pizza restaurant near the campus, and we enjoyed the drinking party.



Group photo with Lee group (the Second man from the right is Prof. Seung-Wuk Lee)

Summary

Through the program, I had a motivative experience which I could not have in Japan. The inspiring air of campus and rationalized environment for researchers, and interaction with high-motivated students all changed my way of thinking, and widened my view on both science and culture.

I would like to express my sincere gratitude to Dr. Okamoto and Dr. Yamaji, who led us to San Francisco, people in charge of MERIT program, who gave me this chance, and members of each laboratory, who kindly accepted me to visit. Especially I would like to appreciate Prof. Waymouth and Prof. Lee to host our visit in Stanford and UC Berkeley. I am sure that this experience made me grow a lot. Again, thank you very much.

Department of Chemistry and Biotechnology　M1　Hiroko Kawano

I participated in the overseas training of MERIT program. I visited laboratories of Stanford University and UC Berkeley. I'll report activities of each day in detail.

【2/24 Stanford University】

Yan Xia Group

The research topic of this laboratory is the development of new ways to synthesize polymers. Three researchers gave us presentations of their own researches. One of them introduced the research about a new method to synthesize homopolymers by using strain of monomers. I was so excited that they introduced the latest studies that just came out in the paper. We had a chance to present our research results for about 5 minutes. It was valuable experience.

Robert Waymouth Group

This laboratory researches the way to synthesize polymers by using cyclic monomers. At first, I was afraid that I couldn't understand researches of this group because the field of researches is totally different from the field of my research. But I could understand them to some extent because students in this group politely explained their research again and again by using posters. I participated in the meeting of this group. During the meeting, many researchers gave their own opinions and the argument was very active. After the meeting, I gave a presentation of my research and they asked me several questions. I believe it was very meaningful for me to discuss my research with a lot of researchers.

Hongjie Dai Group

This group is developing new materials by using carbon nanotubes and graphene and so on. A Japanese visiting researcher guided us around their laboratory and explained researches going on now. He came from a company. So he objectively told us the significance of studying in the U.S. and the good point of researching in a company from different points of view. He said the good point of researching in a company was that you could learn about marketing and you could make what customer wants. He showed us common devices such as NMR. In the room of common devices, maintenance staff is always on duty. So students don't have to take time to maintain machines and they can concentrate on their own researches.

【2/25 UC Berkeley】

Chris Chang Group

This group is performing brain mapping and the development of probe by using fluorescent materials. One of students guided us around the laboratory. I asked her some questions about the daily research life and she kindly answered them. That was very useful information. She showed us other laboratories in the same building and I could luckily observe the facilities of the laboratory of Professor Omar Yaghi, who is very famous for researches of metal organic frameworks.

Ting Xu Group

This group is developing various materials by regulating self-assembly of molecules. I was surprised that the place of experiment per person is large. We had a chance to talk with three researchers about research life during lunchtime. I asked why you had chosen this laboratory and one of them answered this is because Professor Xu is a wonderful researcher. Those words stuck with me.

Dean Toste Group

The research topic of this group is the development of new catalysis. Post doctors guided us around the laboratory. There are many expensive devices such as a large peptide synthesizer. They performed experiments with some members of other laboratories in the same room. I thought this was good environment enabling collaborations with other laboratories. They also showed us libraries and lecture rooms of UC Berkeley. The library was very huge and there were many rooms to study. There was a rule that people could chat in the library in the school of engineering in order to encourage discussion. That was very interesting for me.

【2/26 UC Berkeley】

Matt Francis Group

This group performs observations of self-assembly of proteins and the drug delivery by using chemical modified proteins. I participated in the group meeting. In the meeting, they talked about how to improve the way to perform experiments. That was very intensive discussion. I thought it was very difficult to understand researches because the field of research is not chemistry but biology. However, I had a chance to ask some questions about researches, I could develop my understanding.

Kenneth Raymond Group

This group is researching luminescent materials made of metal complex and applying these materials to MRI contrast agent. One of students guided me around this laboratory and explained their researches. The number of students was small but this laboratory was very active. They held meeting once per three or four weeks and they individually discussed with

professor once a week.

Brett Helms Group

This laboratory belongs to national research institute, Lawrence Berkeley National Laboratory. They guided us not only around this laboratory but also around the entire research institute. This institute was fitted with up-to-date equipment such as huge clean room and glove box in which you can perform all reactions. Fortunately, professor directly explained his research. They developed a totally new membrane, which can selectively permeate metal ions by controlling angles of molecular structures. This research was difficult to understand but very innovative. This was very good leaning experience for me.

Seung Wuk Lee Group

The research topic of this group is self-assembly of molecules. I could attend the meeting in which undergraduate students gave a presentation of their own works. As a part of a class, they were required to collaborate with this laboratory and advance research by themselves. I thought we should adopt such systems because undergraduate students have a little chance to participate in researches of laboratories in Japan.

【Impressions】

Thanks to the kind arrangement of professors, I could visit ten laboratories only for three days and have a fulfilling time. Every laboratory has the latest instruments and the research environment is prepared. I was surprised that small laboratories also can use the latest facilities because the system of common devices was well developed. And I was so impressed that all members actively gave their opinions in the meeting. Unlike in Japan, there is no master course and all students took it for granted that they should get PhD. So their motivation was really high. I learned the importance of progressive attitude from them and I actively asked some questions and gave presentations of my research. Most researchers started their work from early morning and went back home before dinner. They worked very efficiently. I want to adopt such a stance. And I heard some laboratories collaborate with companies. To my surprise, many companies rent rooms in Stanford University. I thought we also need mechanisms enabling to promote collaborations between universities and companies.

【Acknowledgement】

I am deeply thankful to teachers who planed this overseas training, staff of MERIT office

and teachers leading us in the U.S. I am grateful for the assistance given by Prof. Aida. I would like to express the deepest appreciation to professors, researchers and students in Stanford University and UC Berkeley. Thanks to you, I could have many precious experiences. I want to use these experiments to grow and work harder than ever. Thank you very much.

MERIT oversea training program report

Department of chemistry and biotechnology Ryuji Misawa

2/23 Stanford University

We visited Stanford University with all of us on the first day. In the morning, we had campus tour. The beautiful climate and the sense of openness in the huge campus of Stanford impressed me the most. In the afternoon, we had lab tour of Zhenan Bao group and Harold Hwang group as well as some shared facility. After that, we had workshop with group consist of MERIT course student and Stanford students and postdocs. Through this entire trip, I did not feel uncomfortable with discussing about research issue in English. However, I rather felt it difficult to talk about more causal topic in English.

Picture of Stanford University.

I visited some laboratory from the second to forth day where I made appointment by myself.

2/24 Visit to Bianxiao Cui group

I visited Bianxiao Cui group in department of chemistry at Stanford on the second dayr. This research group is developing detection system of axon potential propagation by culturing neuron on nanopillar electrode substrate. Also they are interested in the optogenetic control of organelle transport especially NGF. Firstly, I talked with professor Cui for around 30 minutes about myself and this trip, my research project and some projects conducted in her laboratory. After that, a PhD candidate student was introduced and we discussed about the research issues and the life of PhD student in the US while drinking coffee. He was having quite a few projects on going and he explained me one by one in detail. He showed much interest in MERIT program and told me that the most valuable thing you can get through PhD course is not “skill of doing experiment”, but rather “skill to ask a good question” and “skill to independently proceed the project”.

2/25 Visit to Alex Dunn group and 23&me

In the morning of the third day, I visited Alex Dunn group. Their group is interested in the mechanobiology especially concerning the stem cell self-renewal. A PhD candidate student show me around the laboratory and had some discussion about my research and her research.

In the afternoon, I moved to Mountainview where I met Ms. Litterman who is working for the

company named 23&me. 23&me is a company which is founded by the wife of the founder of Google, and providing DNA genetic testing service. We talked about the MERIT program and the projects in the company.

2/26 Visit to Gartner group at UCSF

On the fourth day, I visited UC Sanfrancisco which is one of the most famous graduate school in medical field. The campus was about 1.5 hours away from Stanford by train, and the campus was more sophisticated and the area is much smaller than the Stanford campus. I was going to meet with the graduate student and postdoc at Gartner group at 15:00. However at exactly the same time and in the same building, Prof. Jennifer Doudna was giving the seminar. She is one of the scientists who found the CRSPR-Cas9 as gene editing tool and expected to win a Nobel Prize in some day. So we changed the time and listed to her presentation.

After her seminar, we had a lab tour and discussions about their research project and my project. They are interested in the cell patterning using the complementary sequence of DNA as a glue whereas our lab is interested in the cell patterning using photo-responsive PEG lipid. So, in that sense, we had very similar interest, but different strategies. However, when we discussed a little, I was surprised to know that they are recently working on the cell patterning using light to improve the throughputness of their method. Also we found that we had similar kind of problems during the research. We had very interesting time for both of us.

Summary

One week was a little short time, but I was able to find some differences of the research environment of the US and of Japan.

For example, I was surprised to know that laboratories in the US share so many facilities and they pay the money depending on how much time they used the facility. They save money by doing that way, but instead they hire people who are responsible for repairing the facility when they are broken for some reason. I though it is very cost effective compared to the situation in Japan where each lab has some very expensive equipment and quite a time is needed for repairing because we need to send them to the company or fix them by ourselves every time.

Also, the students in UCSF told me that there are seminars by famous scientists such as

Jennifer Doudna every day in top level university such as UCSF. In those kind of seminar, the speaker often talk about unpublished data, and I though those kind of different amount of information of the most recent scientific knowledge make the US science society so high level.

Acknowledgment

I am very thankful for the people in MERIT course who gave me this kind of very useful opportunity.

Report for the MERIT Overseas Training

Masahiko G. Yamada
Department of Physics, School of Science, the University of Tokyo
The Oshikawa Group, the Institute for Solid State Physics

My purpose for the MERIT overseas training is to visit Massachusetts Institute of Technology (MIT) and discuss with my collaborators, Mr. Tomohiro Soejima and Prof. Mircea Dincă, as well as to visit Stanford University. They have been good partners since I was a senior student (B4) belonging to the Aoki Group in Department of Physics, Faculty of Science, the University of Tokyo (UT). Especially, my research done in the Aoki Group, which was related to new two-dimensional metal-organic frameworks, finally lead to the submission of my first paper "First-Principles Design of a Half-Filled Flat Band of the Kagome Lattice in Two-Dimensional Metal-Organic Frameworks." This collaboration is not only an international one between UT and MIT, but also an interdisciplinary work between the condensed matter theorists and the chemistry experimentalists about two-dimensional materials newly discovered by chemists. Such collaboration between physics and chemistry should meet the goal of the MERIT program, which aims to overlook every field in the materials science and to have an international mind to solve global-scale problems. Therefore, I want to expand our relations using various opportunities in the future with this overseas training as a starting point.

For these purposes, I planed a very active schedule for the MERIT overseas training. I am very grateful to the MERIT office and Prof. Ichikawa for accepting my "unusual" schedule. My plan is as follows: visiting Stanford University (the west coast) from Feb. 22nd to 24th, flying to Boston (the east coast) by midnight flight on 24th, visiting MIT from 25th to 26th, and flying back to San Francisco. This is a "bullet tour" flying across the U.S. for a one-night stay, but I think the unusualness of this trip made many people in MIT easy to remember my name and face, so this schedule was very useful in

the sense that I made a lot of friends in MIT. Especially, Dr. Itamar Kimchi in MIT, who I met for the first time in the MERIT overseas training, attended both to the international workshop "Topological Phenomena in Novel Quantum Matter: Laboratory Realization of Relativistic Fermions and Spin Liquids" in Dresden, Germany and to APS March Meeting 2016 in Baltimore, the U.S., so we were able to meet together on these occasions and he actually became good friends. Similarly, I had diner with Dr. Hiroki Isobe, who I also first met in the MERIT overseas training, in APS and we were able to talk about the life in the U.S.

Group Activities on Feb. 23rd

On Feb. 23rd, all participants in the MERIT overseas training saw around Stanford University introduced by Mr. Kurosawa, and then visited the Hwang Group and the Bao Group. There is nothing to be specified by me, but it was a good opportunity to visit not only the condensed matter group (Hwang), but also the chemistry group (Bao).

Fig. 1 the SLAC facility

Shen Group on Feb. 24th

On Feb. 24th, I visited the Shen Group in Stanford University with participants such as Mr. Hashimoto. We saw the facilities of SLAC National Accelerator laboratory as well as Shen Lab. in Palo Alto campus of Stanford University. Especially, there are a lot of cutting-edge optical measurement devices, ARPES (angle-resolved photoemission spectroscopy) along the beam line of the Shen Group in SLAC. This is the first time I saw the composite system of ARPES and MBE (molecular beam epitaxy), and I was amazed to imagine how many theses they can produce. I thank to Mr. Ma, Mr. He and Mr. Lu in the Shen Group for introducing us to the laboratory and to Mr. Hashimoto for planning a schedule for this day.

Dincă Group on Feb. 25th

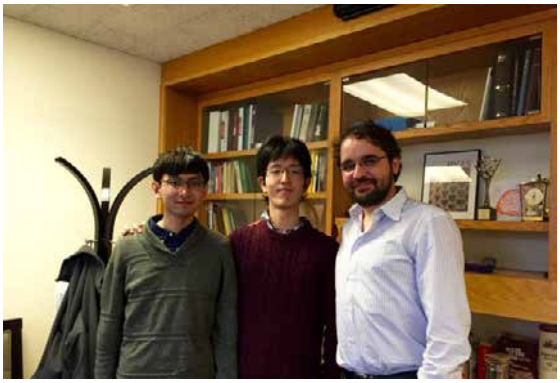


Fig. 2 writer (left), Mr. Soejima (center) and Prof. Dincă (right)

On Feb. 25th, I moved to Cambridge (Boston) and visited the Dincă Group in MIT. They are researching many kinds of metal-organic frameworks and recently focusing on the physical property of these materials. In the morning, I discussed with Prof. Dincă and Mr. Soejima and in the afternoon I presented a group seminar in the Dincă Group. The purpose of this seminar was to explain my first research, "First-Principles Design of a Half-Filled Flat Band of the Kagome Lattice in Two-Dimensional Metal-Organic Frameworks" to chemists. However, I think this was not satisfactory due to my lack of preparation and chemical knowledge. I want to regret this failure and practice how to present to chemists, but what I learned from this opportunity is that using a chemical language is not enough. First of all, chemists and physicists are working from different motivations and it is difficult to tell how complicated the problem, such as "why can materials be ferromagnetic?" is, which must be stated before moving on to how to solve it. We, physicists are interested in strongly-correlated systems because it is a non-linear many-body unsolvable problem, but we have to realize that people who feel like this are only physics geeks. However, the people in the Dincă Group who are interested in physics had a lot of questions and in this aspect it was a very fruitful opportunity to discuss with experimentalists who actually do research by hand. Even though there is an immature aspect, I want to move forward to realize our theoretical research without remaining on my desk.

Fig. 3 Group Seminar

In the evening, I happened to attend a talk by Prof. Rainer Weiss from the LIGO collaboration, which discovered a gravitational wave for the first time.

There is no direct relationship to condensed matter physics, but it was a very good opportunity to hear interesting stories from a potential Nobel laureate.

Fu Group on Feb. 26th

On Feb. 26th, I visited the condensed matter theory group in MIT with the help of Mr. Sagar Vijay form the Fu Group. Mr. Soejima also joined us on our way and we were able to discuss my research, "First-Principles Design of a Half-Filled Flat Band of the Kagome Lattice in Two-Dimensional Metal-Organic Frameworks" with Prof. Liang Fu. He is very famous for his research on topological insulators and topological crystalline insulators, and the two-dimensional metal organic frameworks I discovered also have a topological property, so I think Prof. Fu was very interested in my research. On top of that, I was able to get connections with Dr. Kimchi, Dr. Isobe and Mr. Vijay (of course, I met much more people than I listed in this report), and that was my greatest yield. I strongly hope to make these relationships meaningful for my future research.

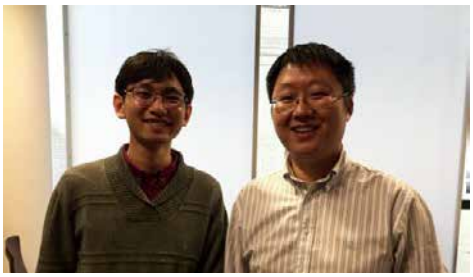


Fig. 4 writer (left) and Prof. Fu (right)
(photo taken by Mr. Soejima)

Acknowledgements

I first thank to the MERIT office and Prof. Ichikawa for accepting this rare opportunity and a one-night trip to MIT. I might have disturbed the supervising instructors, Prof. Okamoto and Lecturer Yamaji, but I am very grateful to them for supporting our activities in many aspects. I again appreciate the help of the people in the Hwang Group, the Bao Group and the Shen Group, and of Mr. Hashimoto who made a schedule on Feb. 24th. I am very grateful to Prof. Dincă and Mr. Soejima for setting our discussion and my group seminar. I also thank to Prof. Oshikawa, who introduced Prof. Fu to me, and Mr. Vijay, who arranged my schedule on Feb. 26th and showed around MIT. Finally, I want to say a great thank you to Mr. Mishchenko, who did almost everything for the overseas training single-handedly.

MERIT Overseas Training Report

Nishihara lab, Department of Chemistry
Keisuke Wada

During MERIT overseas training program, I was given an opportunity to join a campus tour at Stanford University, and individually visit research groups at Stanford University and University of California, Berkeley. I report herein this precious experience.

Feb. 23th Campus tour at Stanford University

During campus a tour at Stanford University, its staffs guided us to attractions and academic faculties. First of all, I was surprised to its vast space occupation compared with Japanese colleges; moving around there was difficult without buses or bicycles. Designs of all buildings are unified, which made me convinced that the university itself could be a sightseeing spot only by its campus.

After the guidance, I visited facilities of some departments such as Applied Physics and Chemical Engineering. I was highly impressed by these facilities' advancement and value. In order to improve the efficiency of research conducting and lowing the budget cost, most of machines are directly owned by university itself, rather than individual groups. Moreover, mechanical maintenances of these facilities are done by specified technicians to provide more efficient academic environments for students. In my opinion, Japanese universities could extract some worthwhile information from these system.

I also had a time to communicate with its students and researchers after seeing facilities. The meeting started from introductions of our university and Stanford University, and then we freely talked about not only scientific but also several topics such as lives in Japan and U.S. Then I noticed that what they felt about their society, science and lives are much closer to mine than I expected even if our nationality are different.

The Oval and Main Quad at Stanford University

Feb. 24th Visit to Stanford University

I attended a lecture, Entrepreneutrial Thought Leaders (ETL), which is presented by

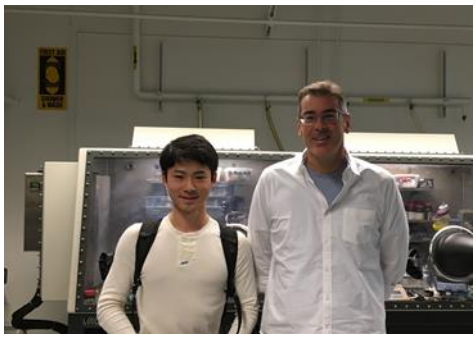
CEOs from various companies. Although the contents was a little diverse from our field, interesting story and useful tips based on presenters' experiences fulfill me very much.

Feb. 25th Visit to Christopher Chidsey group at Stanford University

Professor Chidsey is one of respected pioneer among the field of electrochemistry. Due to the reason that my research topic is highly correlated to his field of study, I was really looking forward to visit his group. He kindly spare more than 2 hours for the discussion. During the discussion, he patiently pointed out problems and its solutions about my own research. Moreover, he explained researches conducting in his group and his prospection, the way to efficiently design catalysts for general chemical reactions. This system is about automatically designing the effective catalyst by combining robotics or computational chemistry (in concrete, DFT, etc.). Its realization should give us a technique like a dream. At last he said that he wanted it to be realized by next generation researchers, so I want to keep thinking somewhere in mind as a scientist.

Feb. 26th Visit to Jeffrey Long group at University of California, Berkeley

I was interested in him because he is very famous professor as a researcher of MOF and my group are investigating two dimensional MOF materials as well. In these days his group succeeded in synthesizing a MOF having innovative property which is greatly expected to be applied to gas separation or storage. When I actually talked with him, I noticed that he considered their application by far more than I thought, so I felt they would be really used in many factories or energy plants. After I got brief explanation and asked him about some questions, one student introduced me the laboratory. Because the group conducts the latest researches about gas separations, there were a lot of gas absorption machines. I could also listen to detailed explanations about MOF for battery electrodes which is another topic done in the group and I was very interested in.



With Prof. Jeffrey Long

Summary

Since that trip was the first time for me to individually visit universities and research groups in a foreign country, everything was new for me and I could spend really meaningful time. There, it was common for every group that they had open minds about researches and

human relationships. I felt that such an open mind sophisticates eyesight for looking over barriers of groups or fields and has generated American innovations. Therefore, in order to achieve the goal of MERIT program, first I want to keep the open mind anytime.

Acknowledgement

Finally, I greatly appreciate the staffs, especially Dr. Okamoto and Dr. Yamaji who organized this program or guided us in U.S., and everyone in Stanford University and University of California, Berkeley who kindly welcomed my visit.

MERIT Oversea Training 2016 [Stanford]

Lippmaa group, ISSP
Jiyeon Lee

2/23@Stanford

On the first day of the official schedule, we first toured whole campus of Stanford university. Unifying colored buildings, main quad, memorial church and Hoover tower enable us to feel the history of the university. This year is the 125th anniversary.

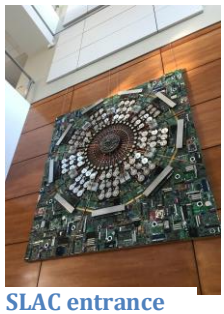

Hoover tower から見たスタンフォード

We also visited 3 labs; Harold Y. Hwang, Yi Cui and Zhenan Bao. I was very surprised that about all laboratory don't have a He retrieving system. All He used to experiment is flown in atmosphere comparing that UT(both Kashiwa and Hongo) has special central-managed He system. Only Harold Hwang's lab has his own retrieving machine, but I heard that its back pressure is too high to transfer by small pump.

There was a student workshop from evening. We talked about different lab life between Japan and the US. We also discuss general scientific issues, such as human brain vs AI.

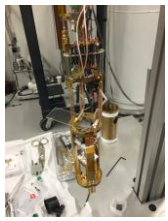
2/24@Stanford(SSRL, Shen lab, MIM , SLAC)

In SSRL(Dr. Yu), we saw fancy experimental equipment that combine ARPES, MBE and so on. It seemed very convenient to be close to synchrotron that various kinds of experiments can easily be done in the university. After looking around the facility, we moved to the campus again and visit Shen lab. MIM, microwave impedance microscopy, requires very sensitive circumstance such as vibration. It has few uers(only 2 PDs) and it is possible to use a machine for more than 1 week for one user.


SLAC entrance

After lunch, I went back to SLAC and visited Dr. Kazunori Nishio's place. I saw a new movable PLD which is planned to be connected to laser ARPES of the Shen lab. I could see people making film and talk to one Japanese student. I was surprised at protection system. When someone is using laser, door cannot be open.


Protection system


MIM

2/25@Berkeley(Ramesh lab, Hwang lab)

On the second day, I visited R. Ramesh group of U.C. Berkeley. There were 3 excimer lasers and 9 PLD chambers that one eximer laser is used for 3 chambers. They don't use laser-heating or twist-machine-controlled target rotating system and it was my first time to see them. I heard that there is a building full of clean rooms.

I came back to Stanford again, and then met two Korean members of Hwang lab; Dr Bongju Kim and Ms. Hyeok Yoon. We talked about systems among US, Japan and Korea. Shortly, we noticed that there are differences not just of nation, but also of each group.

2/26@Stanford(Suzuki lab, Toshiba America)

On the last day of free activity, I visited Y.Suzuki's group in Stanford. Her group moved from U.C. Berkeley in 2012 that was quite small group of few people 1 eximer laser and 3 chambers. However, there are many fancy machines they can use as public use and they just should paid for the using.

Public facilities

On this day, I had lunch with Dr. Shur and Dr. Kim who are PD of Hwang lab at student cafeteria. They recommended me to come to the US after getting Ph.D.

After lunch, I visited Mr. Taisuke Sato from Toshiba America. He will be back to Japan this March and he said the situation around Toshiba America is not that good. I could ask him about life and work in America.

Through the whole activities,

I felt that all flow of people, information and money directed to the US. Also, UT has one of the best experimental facilities comparing to world-class universities. This oversea experience let me realize that the research life abroad is very attractive. I will visit the US again before the graduation of Ph.D. and want to broaden my horizons again.

Acknowledgement

This overseas training was conducted with the help of a lot of people concerned. In my stay, many professors, researchers, students and my friends hosted me and gave me a precious experiences. Especially, I want to thank to Prof. Ramesh, Dr. Turcaud and Dr. Nishio for letting me look over the lab facilities. Also, Dr. Kim, Dr. Shur Ms. Yoon and Mr. Sato for kindly sharing his/her precious experiences. Furthermore, secretariat of MERIT did many procedures about this program. Finally, Prof. Okamoto and Dr. Yamaji lead us throughout the whole stay. Thank you very much for all.

MERIT oversea training program report.

47-156039　TOBITA Kazuki

1　Tours with all members(2/23)

We first took the guided tour in the campus. We learned about the history of the Stanford and we went to the top floor of the Hoover Tower, which had grandstanding view of the campus. The campus was so huge to walk around that most of students rode bikes.

We saw some facilities in the department of chemistry and physics afternoon. What strikes me was that they had so many small rooms with whiteboard that they could discuss some topics easily and share some ideas. Due to fatter budget for research in Stanford than that in Todai, the labs had many postdocs and technicians. The facilities for common use were managed by the technicians so that they could fix the facilities quickly in case they don't work.

After the labs tour, we had the opportunity to discuss with students in the labs. Some of them have masters' or doctors' degree from overseas. The talented students all over the world tend to go to the U.S. and they do outstanding research. Then the other talented students are attracted to go to the U.S. We could see these virtuous cycles. There is a big difference between the U.S. and Japan how the postdocs and doctoral degree holder are treated.

2　Individual visiting(2/24-2/26)

2.1　Motivation

Prof. Krill Kovnir is doing research on the thermoelectric materials as I am. Although we don't focus on the same systems, there are many affinities when characterization and measurement of thermoelectric properties. Now I am familiar with sample making process, but not familiar with characterization. I decided to visit this group because I am interested in the characterization in this lab.

Prof. Susan M. Kauzlarich is a leading person in Zintl compound, which has high thermoelectric performance. This lab's website is not updated so long time that we don't have much information about this lab. I would like to see how they achieve many startling results.

In these labs, students guided me and gave me the proper information about their research. Then, the professors gave me the opportunities to present my research.

2.2　Schedule

2.2.1 Prof. Kirill Kovnir group

The postdoc in the lab guided me at first. Because my research background is solid state physics, but they are in department of chemistry, the facilities for sample making were seemed to be different. Although the facilities for measuring thermoelectric properties are similar to my lab, they can contact some labs in Europe to use facilities for characterization because the professor was used to be in Max Planck Institute. Then he explained their research. I had already read some of their papers which helped me understanding what he said and I was able to ask some questions. He was so kind that he spared more than two hours for me.

Finally, I presented my research to the professor, and he gave me some advice.

2.2.2 Prof. Kauzlarich group

I attended the seminar which one of group members presented. After that, students guided me the lab. Because the professor was so busy that she couldn't spare time, they suggested me that I would meet her next day.

The picture with student in Kauzlarich group

On the last day of individual work, I attended the meeting in the lab, which she gave me the opportunity to present my research. They gave me some advice. After finishing my visiting, one of the students kindly spare time to have lunch with me. He told me not only research work, but also their everyday life in the lab.

3 Feed back

My purpose for this training program is contacting some professor or students in oversea. This connection will help me to differentiate my research from the competitors. In order to archive this purpose, I did not only seeing the facilities but also presenting my research. I hope next time that I could spend more time in these labs.

Department of Advanced Materials Science,

Master 1st grade, Takahiro Hashimoto

2/23 Campus tour of Stanford University, Bao Lab, Hwang Lab, Discussion with students

We went to campus tour of Stanford University and two labs, and discussed with students on the first day of our activity. In the campus tour, it was impressive that many buildings in the campus are named after donor to university. There seems to be culture of donation. I was surprised to see a building named after Gordon Moore, who proposed Moore's low. In Bao Lab and Hwang Lab, stuffs politely explained their research, showing their experimental devices. In the discussion with students, I felt my outlook for future technology is not different from those of students that I met.

Free activity

During three days of free activity, I visited Shen Lab at Stanford University and Stanford Synchrotron Radiation Lightsource(SSRL) at 2/24, Lanzara Lab at UC Berkeley and Advanced Light Source(ALS) at 2/25, Moler Lab and Fisher Lab at 2/26.

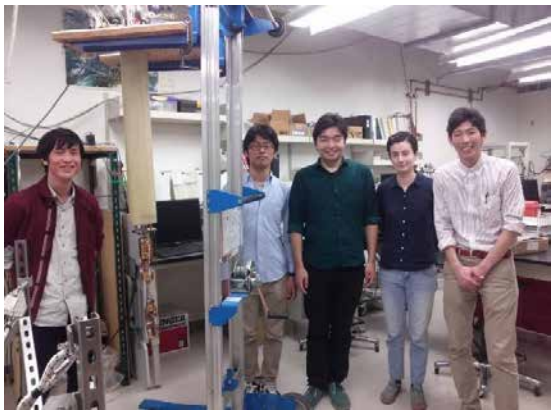
City of Berkeley from ALS

・2/24,25 Shen Lab, SSRL, Lanzara Lab, ALS

Angle-Resolved Photoemisison Spectroscopy (ARPES) is primary experimental method of Shin Lab which I belong to. I visited labs and synchrotron radiation facilities with ARPES. I could exchange detailed information of each experimental device with students and stuffs. It was very exciting to see high energy solid-state laser in Shen Lab and high efficiency spin resolved photoelectron analyzer in Lanzara Lab. Versatile experimental device with several additional functions are being built in both synchrotron radiation facilities. I felt the trend of doing several experiments without taking samples to atmosphere. It is good for Stanford University and UC Berkeley that they can choice high resolution laser and versatile synchrotron, because synchrotron radiation facilities are located near to university. Experimental devices are large and I was surprised at their financial power. I was stimulated to think what I can do and what is necessary in my lab, by visiting other labs.

・2/26 Moler Lab, Fisher Lab

I could see Scanning SQUID which probes positional dependence of small magnetic field in Moler Lab. In Fisher Lab, I could see experimental setup for investigating the nature of breaking of four-fold symmetry in crystals by utilizing piezo element. I could feel enormous possibilities of investigation for new solid state physics by new experimental probes.



At Moler Lab

Acknowledgement

I thank to planners of this oversea training. I acknowledge Mr. Ichikawa, who planned this trip and Mr. Okamoto and Mr. Yamaji, who led us during the trip. I also appreciate people in Stanford University, UC Berkeley, SSRL, ALS for kind acceptance of my visit.

Report for MERIT Overseas Training

Department of Advanced Materials Science, M1
Arima & Tokunaga group, Yuri Fujima

I stayed in San Francisco for a week for MERIT overseas training, visited some laboratories and discussed about my research with members in the laboratories.

【Feb. 23rd】

All of us went around the Stanford University and talked with students and staff working there.

【Feb. 24th Shen Laboratory & SLAC National Accelerator Laboratory】

I visited Z. X. Shen laboratory at Stanford University and SLAC national accelerator laboratory and saw their facilities. Shen laboratory is famous for photoemission spectroscopy. They have laser photoemission spectroscopy systems in their laboratory, but also have their beamline in SLAC. It was good experience for me because I often use accelerator facilities. Although it was under construction, photoemission spectroscopy systems with molecular beam epitaxy machine is amazing that enables complete in situ measurement. They also have microwave impedance microscopy (MIM) system. By using it, we can measure local impedance in samples. For example, measurement of domain wall conductivity of all-in-all-out structure in pyrochlore lattice is one of applications of MIM technique.

Fig.1 Photoemission spectro-scopy system at SLAC

【Feb. 25th Fisher Research Group】

I visited I. Fisher research group at Stanford University, saw their facilities and experiments, and discussed my research with Dr. Jiun-Haw Chu who is postdoctoral associate there. They conduct both bulk single crystal growth and its measurement. Single crystals are grown by flux method or floating zone method using tetra arc image furnace. It was a bit surprising that they said they are reluctant to grow crystals by

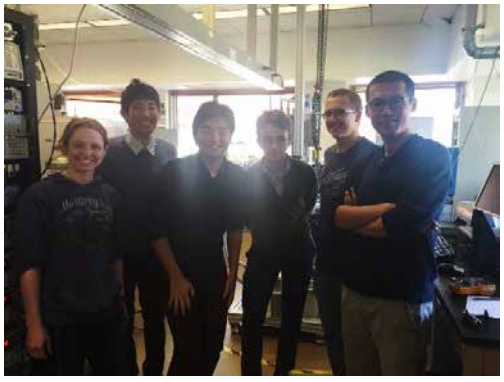


Fig.2 Photo with Fisher group's members

floating zone method because they cannot go away during crystal growth. Measurement in Fisher laboratory is mainly electric conductance measurement with piezoelectric device inducing stress in samples. In discussion, we talked mainly about crystallographic domain problem. In my research, it is very important to avoid from making twin domain with structural phase transition. Although target samples and phenomena are different, Fisher laboratory conducted the measurements with uniform crystallographic domain. They showed me a technique for the measurement, and it was really fruitful time.

【Feb. 26th Moler Group】

I visited Moler group at Stanford University and saw their facilities. They are professionals for development of scanning SQUID measurement system that enable us to measure local magnetic flux. It was interesting that SQUID device and samples are placed upside down in the probe and manipulated by piezoelectric device to achieve fine scanning. Its space resolution is an order of 100 nm. They are now working to commercialize it. It was good experience to see measurement machine development.

【Overall Impression】

There are various people from all over the world, and the research environment seems to be really exciting. It was a shame not to be able to communicate aggressively due to my lack of English proficiency. I will improve my English and would like to study abroad for longer term in the future.

【Acknowledgement】

I would like to express my gratitude to the stuff in MERIT program for making this overseas training. My deepest appreciation goes to the escorting staff, Mr. Okamoto and Mr. Yamaji. I also would like to thank Prof. Shen, Prof. Fisher, Prof. Moler and members in their laboratory for willing consent to my visit.

Repots on MERIT oversea training

Department of advanced materials Sciences M1 **Suguru Hosoi**

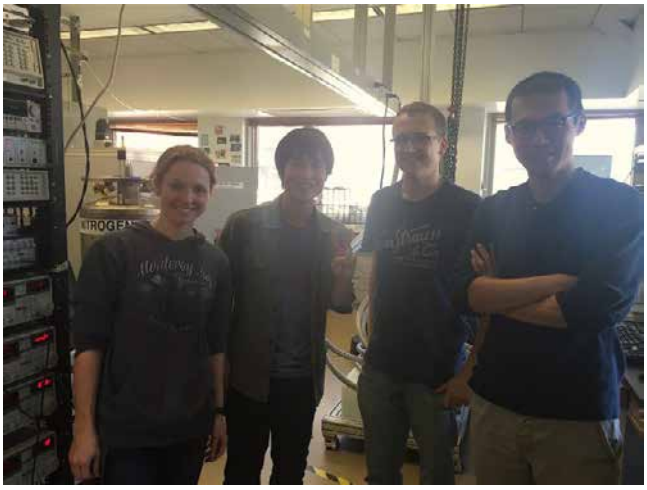
This visit to Stanford University took only 5 days but it was so stimulus that I was very motivated to do my research more intensively thorough this experience. On 23rd. Feb, I was overwhelmed through lab tour by large scale of research equipment of Stanford university. Through discussion with foreign student, we can also study a lot of things but at the same time, it makes me notice the lack of my English ability. We had three days for free working time from 24th from 26th and in my plan I was going to visit Prof. Fisher's laboratory thorough this duration. However, planed experiment finished in 2 days so I rescheduled and decided to go to Moler Group. In this report, I report on my working in both two laboratories in detail.

24th and 25th Feb ` Fisher Group

I met Prof. Fisher at 9:30 on 24th and discuss about our research for about one hour. I had a fruitful discussion with them. In fact, I choose this visit because my research is measurements of elastoresistivity and Fisher group proposes this method. Although measurements of elastoresistivity in iron-based superconductors is known as strong probe which can experimentally evaluate nematic susceptibility, these measurements is conducted by only me in Japan now so it was valuable experience to discuss about nematic susceptibility. We discuss about the results of preliminary measurements in each laboratory. He had great interest in my data and repeatedly said, "I love it". Finally, I could ask his opinions on analysis of nematic susceptibility from the theoretical view and all these experience are useful for me to widen my vision.

After discussion with Prof. Fisher, Dr. J. H. Chu guided his laboratory and observed actual measurements of nematic susceptibility for two days. In fact, these experimental methods were developed by him, he teach me many kind advices about my questions which I had been suffered through experiment and analysis. In addition to Dr. Chu, Johanna and Elliot show me how they do experiments. I was afraid that I was not welcomed because of competitors but when I met them, they intensively taught me experimental techniques and it help me to studying skills. Other members also aggressively explain

about their research topic and I felt all members are friendly. Measurements often causes trouble and in fact even during my visit it occurred, however, in their group trouble-shooting should be solved by themselves. It seems that through this procedure, each student obtains own skills. Throughout my visit, I had a lot of things to study however I can also be confident in my measurements.



A picture with Fisher Group member

26th Feb. @ Moler Group

Experiments and discussion in Fisher Lab finished than I expected so I visit Moler group before I mentioned. In this laboratory, they develop scanning SQUID microscope and it is very sensitive probe to observe local magnetizations, which have very important meaning for studying physics. Hilary and Chris, graduate students, explained me the details of the apparatuses. This group mainly focuses on increasing measurements sensitivity so I felt difficult about technical details but also felt fresh. This visit makes me look forward to doing research because I am thinking I develop new probe, which is completely different from SQUID though.

Summary

I was able to widen my vision through this experience that we saw the larger and different laboratory in U. S. Especially I studied practical skills for future research through experiments and discussion with members of laboratory, which I have been desired to visit.

Acknowledgement

I really appreciate MERIT stuff offer me valuable opportunity to visit Stanford University as overseas training. I also thank members of Fisher group and Moler group for their kind welcome.

Material department　Arima&Tokunaga lab. Kana Maeshima

During the trip, I was stolen my baggage, and then I went to hospital. My tough experience might be useful for the minors.

In my free time, I visited Moler laboratory in Stanford University, Siddiqi laboratory and Long laboratory in UC Barkley.

3/22　moving Narita to San Francisco

I was really tired after long flight because I didn't sleep well. A mask, earplugs, neckpillow were very useful for relaxing. In addition to them, I think the chair which I can put my legs will help sleep.

[Stolen my baggage]

On my way to Palo Alto from the airport, I was stolen my baggage in platform. I realized my baggage was gone after getting on the train. Immediately I, Dr. Okamoto and Mr. Michenco got on the taxi and went back to the station. But my baggage was gone. Our taxi driver took us to the police (Police report is needed to receive insurance service). He spoke funny stories for me, and at the end of the journey, hug each other. I was very sad because my baggage was gone, but his kindness made me happy.

[Went to Stanford medical center]

I've lost my baggage, including my medicines I need to take during the trip. So I went to Stanford medical center with Dr. Kurosawa in Bao laboratory. I could see the doctor and get the medical prescription, but accounting procedure was long. As I expected, medical expenses were huge. After that, we went to pharmacy. Medicines were in the plastic case looked like supplements.

[Travel insurance]

I had travel insurance. In order to check the procedure, I called the insurance company before getting back to Japan. After the arrival, I send the documents to them and now procedure is in progress.

Receipts or written guarantee of stolen goods are necessary for getting insurance support. Fortunately, I bought laptop and iPad through the Internet, so I can get receipts easily. I recommend you to keep these important documents of expensive goods.

And the insurance company doesn't support medical expenses because I was suffering disease before the trip. Like my case, travel insurance support is limited. You should check the detail of insurance contracts before the trip and take the booklet about that.

[Preparing for the theft and baggage lost]

I got in trouble when I lost my baggage, but some preparations helped me.

First, I could get prescription easily because I knew the general name (not commercial one) of my medicines. If you are receiving treatment, I recommend you to note the disease name and medicine names in English.

Second, I had backup data of my laptop. And I uploaded files on line about trip schedule, information of hotels and insurance contract number, so I could check them through smartphone.

And last, I put on the pochette including wallet, cellphone, passport, Wi-Fi rooter and camera. I recommend you to keep these important good in your side in case of theft.

I regret I lose attention to baggage. When I will go to a trip, I will take smaller and lighter baggage.

3/23　Visit to Stanford University, communicate with students

Luckily it was fine and warm like in early summer. Dr. Kurosawa in Bao lab introduced us around the huge campus of Stanford University. It looked like a town, which its buildings are the same colors.

(Picture 1) Stanford University

[Cui lab]

I watched experimental facilities sharing with the building members. There were many clean rooms that are monitored by cameras. Building members could use these facilities freely if they paid allotment money. I was surprised at efficient management in Stanford University.

(Picture2) monitoring cleaning room

[Hwang lab]

I watched Vacuum chambers for making thin plate and dilution refrigerators. Some equipment was attached the label indicating it came from University of Tokyo. I heard they had carried with ship. I wondered how much money Hwang laboratory had paid.

[Bao lab]

Experimental rooms of Bao laboratory were very tidy. Generally, chemical experimental rooms are chaotic, because most of lab members don't keep clean of their foods and reagent shelves. Bad condition like that sometimes occurs　(fire) accidents or sample contamination. So, I thought Prof. Bao told her lab members to clean the rooms.

[Communicating with students]

Separated to some groups, we communicated with students of Cui, Hwang and Bao laboratory. I talked with two students from Hong Kong and South Korea. Unfortunately, I couldn't speak well about my research because I didn't have laptop and documents. They said they felt pressure from the students who wanted to start a business. I thought it was specific for Stanford University, which has many famous venture capitalists.

(Picture 3) Students in my group

3/24 Visit to Moler lab in Stanford University

On behalf of Prof. Moler, Mr. Aaron Rosenberg introduced me to their laboratory.

Moler laboratory were developing scanning SQUID magnetometer and studying magnetic imaging by using it. For the SQUID elements, they had 3~4 dilution refrigerators.

Mr. Aaron studied about spintronic devices. He showed me measurement. His apparatus could image magnetic dipole on the spintoronic device. I was interested in magnetic imaging, and I wanted to study about that. So his research was really exciting for me.

He paid attention to my research about complicated magnetic structure, but I couldn't explain well because of poor English ability and lack of documents. Nevertheless, he said "I hope you come here with your sample." I hope I will do that when I can go three months oversea trip. I will proceed my research and study English harder.

(Picture 5) scanning SQUID magnetometer

3/25 Visit to Siddiqi lab in UC Berkley

I visited to Siddiqi laboratory, because I was interested in quantum information techniques.

Prof. Siddiqi was absent. First, Dr. James Colless explained about laboratory's research outline. Second, Mr. Andrew Eddins told me about his research. Then Dr. Emmanuel Flurin and Dr. Machiel Block taught me about the concept of quantum information using whiteboard.

Because of my poor English ability and lack of knowledge about this

(Picture 6) dilution refrigerator

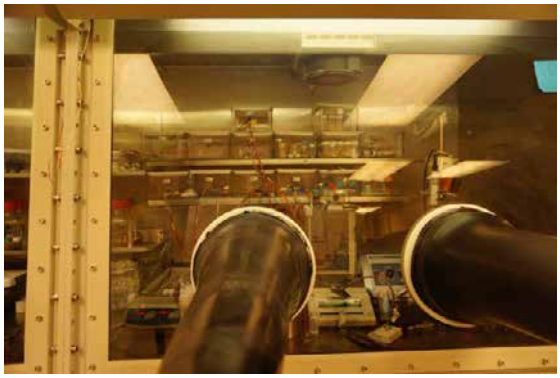
field, I couldn't understand fully. But their patient explanation allowed me to grasp the research concept and to be interested more in this field.

3/26 Visit to Long lab in UC Berkley

In Long laboratory, members were studying on molecules having useful properties, such as magnetism, conductivity, gas absorption. My previous laboratory is similar to them.

First, I talked with Prof. Long. After I talked about my previous research, molecular magnets, Prof. Long explained me about his laboratory's research outline. In fact, they were focusing more on porous materials than on molecular magnets. But he mainly spoke about he latter for me. I was really excited by his idea, bidentate complexes coordinated by double bond and unstable "FeN2" molecule under the high pressure. I had never heard these results in Japan.

(Picture 7) gas absorption measurement apparatus



(Picture 8) glove box

After that, a lab member introduced me around their lab. It was amazing! They had more than five apparatuses for gas absorption measurement, indicating they spent much money and time to get great results. They also had basic measurement apparatus, such as IR, UV, TG, MS, many glove boxes, SQUID magnetometer and Mossbauer spectroscopy measurement apparatus. My previous laboratory had much money but Long laboratory had more.

(Picture 9) Mossbauer spectroscopy measurement apparatus

Then Ms. Lucy Darago told me about her research on molecular magnets. She did measure her sample thoroughly by using their apparatus. And she said they could use synchrotron radiation in UC Barkley.

My research experience in previous laboratory gave me vivid impression of Long laboratory, one of the top labs in the world. I regretted that I hadn't think about my competitors. I decided I study much harder.

My impression

I really enjoyed this trip! During the trip, I got along more with my MERIT classmates. And I'm happy to make relationship the lab members I visited. They were so kind that they listened my poor English patiently and at the departure they said "You can ask me anytime." I hope I will collaborate in research.

And lab trip encouraged me to study English more and more, and visit competitors. Good experiment of this trip made me to stay for research after getting PhD.

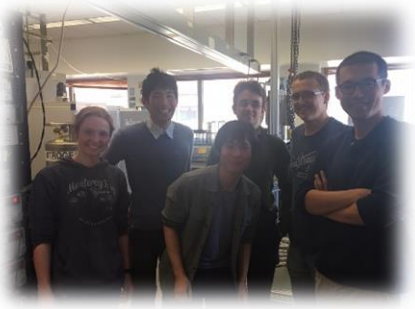
At last, I really appreciate MERIT program, Dr. Okamoto, Dr. Yamaji, Dr. Kurosawa, the lab members I visited and my MERIT classmates.

The report of MERIT oversea training program

M1　Kohei Matsuura

I would like to express my thanks to Prof. Okamoto and Prof. Yamaji, who lead us to the Stanford University, my thanks to the member of secretariat of Merit, who reserve our airplane and our hotel and etc., and my thanks to the staff and student of the laboratory, who accept our appointment and welcome us. In this program, it is very important that we make an appointment with the laboratory we want to visit, make a plan and carry out the plan. I think I had very fruitful time because I communicate with and share the know-how with the staffs and the students in the laboratory whose research topic is very near our one. I can see that the students in Stanford University have a pride to their research. However when we go to the talking about the research. It was difficult for me to understand what they say and to express what I think. So I want to enhance my English skill to share the information without the difficulty. Now, I would like to write my activity in my free activity days.

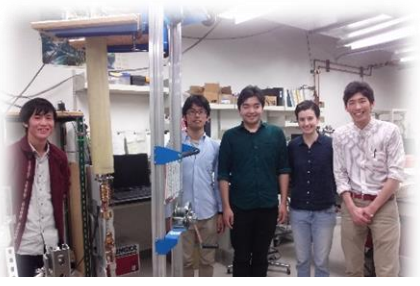
2/24, 2/25: Visit to Ian Fisher Group



At Fisher Group

This research group is the pioneer in the elastoresistivity measurement. Elastoresistivity is a physical property which includes important information about electronic nematic order which is recently observed in iron-based superconductivities. My research group also try to measure this property, so my goal for visiting this group is to exchange our views about theoretical concepts and to share the know-how about experiment technique. I visited with Mr. Hosoi. At first, Prof. Fisher welcomes us and we share the information about our research topics. Prof. Fisher gave us his idea. It is a very good guides. Next, under Dr. Chu show us one cycle of the procedure for actual elastoresistivity measurement. And at the same time, we share our technique for the experiments. I have thought a possible new measurement way for the elastoresisitivity, and have referred to previous research. But I was not able to understand how to analize the data that is obtained from that way. Fisher group have already adopted that measurement way. And Dr. Chu told us about this measurement way. It is very fruitful for me. And I want to try that way. He also show the detwin device he developed for his measurement. I want to apply these device know-how and develop new measurement device.

2/26: Visit to Moler Group



At Moler Group

This research group is the pioneer for developing the Scanning SQUID which is the device for measuring

the local magnetization. Recently, real-space measurement is very important. So I have been interested in this device. My goal of visit to this group is to learn know-how about this device. Moler Group's goal is to develop the SQUID which have higher resolution and to enhance the user interface of Scanning SQUID. When we visit the laboratory they showed us the Scanning SQUID device and show the measurement of local magnetic field around the micro current. The technique adopted for Scanning SQUID is very important for precise measurement. So I want to try to apply these technique we learned in this laboratory tour to my measurement technique.

Department of Advanced Material Science, Kenta Matsumoto

2/23: Stanford University (group work)

On the first day, we visited Stanford University and had a campus tour and a group discussion with students and postdocs.

2/24: Bokor Lab in UC Berkeley

I visited Prof. Jeffrey Bokor in UC Berkeley, who is working on optical measurements on spin current related phenomena. He showed me experimental rooms in his laboratory. Some part of equipment is shared with Ramesh lab and Salahuddin lab and they have many collaborated works. Compared with Japan, laboratories in US seem to be open to other laboratories.

2/25: Liu Lab in UC Davis

Prof. Kai Liu had a lecture for graduated students on this day, and I attended this lecture. In the lecture room, there were several different shapes of tables, which made a relaxed atmosphere. The topics were basic magnetism and magnetometry. This lecture course had classroom lectures, experimental trainings and presentations by students.
After the class, he invited me to lunch. He spared a lot of time for talking with me. It was more than my expectation to have a one-to-one discussion with Prof. Liu. He talked on his recent researches and gave me significant suggestions on my research.

2/26: Suzuki Lab in Stanford University

On the final day, I visited Prof. Suzuki with other MERIT course students. She is researching on magnetic oxide thin films. She gave a grand tour on experimental rooms for material growth and characterizations. After that we had a discussion on research issues. She kindly answered on some fundamental questions and I got a lot of understandings on several research areas.

Closing remarks

For me, this oversea training was the first time to visit a foreign country. Everything in this stay was new to me and I sometimes had difficulty because of my poor English. In order to have a deep communication as a researcher, I strongly felt it necessary to improve my English skills.

Acknowledgements

I deeply thank everybody who give me a chance to participate on this oversea training. Especially, I appreciate Prof. Ichikawa, Dr. Yamaji and Dr. Okamoto for organizing this training.