

Report on Visit to Ruhr-University Bochum by International Training Program

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I will report to here because I participated in the International Training Program (ITP) long term dispatch.

I was going to belong to the Professor Czarnetzki's office of Ruhr-University, Bochum in Germany for two months of from January 7th to March 8th of 2009, and to be engaged in research activities. I feel that it was possible to concentrate on research activities by not only Professor Czarnetzki but also a lot of kindnesses of researcher of Ph. D, Ph. D students, students of master course and engineering officials in this laboratory.

And, it is convinced that these two months were big steps for it just not to have a very big influence on my life as a researcher in the future in experiencing and the business, and to accomplish growth as the person. Because, it was felt that occupied an important position of this long term dispatch those all of life in inexperienced land where not only research activities in the laboratory but also communications with people met in the laboratory, etc. And, it was very significant.

. Moreover, a cultural difference among Japan, Germany and European nations was able to be felt. Especially, the difference on the life side had the big one. As for it, how to advance the research, the usage at time, and how to spend the weekend, etc. took up various topics, and were felt often to have to learn.

In general, it is said that the Japanese is diligent. However, I thought that a researcher in Germany is very diligent, do the usage at very efficient time, through two months in this Germany. And, it was felt that it concentrated and leisure and my time were produced with the conducting research well.

It was made to feel that it was very important for firmly taking communications to know this cultural difference.

It was felt that living for a long term of two months in Germany had been faced greatly and difficultly when there were a difference of the language, difference of the culture,

and a lot of uneasy elements even if procedure and meal one of the dwelling were taken, and it started solving these by my one power. Of course, it is felt also that it is one of the major factors to solve them with an own hand facing the difficulty to acquire an international way of thinking, and to grow up to the researcher who passes in the world. And, when it is a favor of the cooperation of the people of the rule university Bochum , we wish to express our gratitude for being engaged in research activities by not doing a big inconvenience to life to which it doesn't become accustomed in the foreign country, and concentrating. It is felt that communications were able to be taken well by having positively talked to by using English on that.

The apartment of the kitchen bathroom equipping at one station was prepared from the university during length-of-stay with about 30 minutes and trains on foot. Then, it stayed during our January and February in the length-of-stay of two months. Moreover, I was going to stay from Bochum central station to hotel Ibis that was at 1 minute on foot the last one week after in March. The big chill that not was at the ordinary year hit Europe, and it was under the severe weather condition that had not been experienced in Japan named the freezing point under January that arrived at Germany the highest temperature. The climate in the German west with the town of Bochum was comparatively clement also in Germany, and a local student was speaking that it was very unusual that the snow lay thick.

However, I remember the Professor Czarnetzki voluntarily coming to Bochum central station on the arrival day, and having survived very much. Afterwards, the teacher helped variously. After it arrived, the procedure of the apartment was helped, and the shopping center in the vicinity of the university was guided for life. Furthermore, establishment in the university etc. were guided. Especially, I

was very surprised to manufacture machine parts necessary for the research in the atelier in the university at the rule university.

Moreover, the train stopped in the place without the station either because of the snow when taking a streetcar only as a Japanese student at another chance, and it was perplexed. It was possible to come home safely by cooperating among students each other though it had a hard time understanding what situation at that time because the announcement in the car was only German. It is felt that it was also good that the town named Bochum was able to cooperate in the ITP temporary staff because the Japanese is few, and there are only several Japanese students of the level also at the rule university each other.

In research activities, I was going to research concerning the original helicon wave plasma of the guidance of the Professor Czarnetzki. Moreover, I was going to advance the research with Mr. Yusuf Celik who was the student of the postgraduate course for a doctorate to be on the register in the laboratory when I was engaged in research activities. The luminescence of plasma was caught, and analyzed about the effect of the electronic heating of the helicon wave.

First of all, what I had had to do was to have understood by what understanding of this research and policy to advance the research. Moreover, it was similarly important as had the learning of the use of the device to the first stage. The thesis concerning some researches was read for these understanding, and the use of the device was taught from Yusuf that experimented on both. "Helicon-Type Discharge With a Flat Spiral Antenna, Dragos L. Critea, Christopher Isenberg, Dirk Luggenhoelscher and Uwe Czarnetzki, IEEE Transactions on Plasma Science, Vol. 36, and No. 4 and 2008" 4, pp339-364, and 1991" etc. Discernment concerning the helicon wave plasma was able to be deepened by reading these theses.

It was felt even here that the improvement of communications skills and English language skill was able to be attempted by taking communications by using English, and doing an active discussion concerning the research content. And, the research policy such as what experiment you did in a short period of two months was talked about.

And, the experiment of two months is actually shown below. Plasma generated inducement uniting type plasma

(Inductively Coupled Plasma : ICP) by adding the high frequency to the antenna installed in the upper part of the vacuum chamber. Here, 0.1Pa and the high-frequency electricity generated plasma to pressure with 1000W or 1500W by using the argon gas. In addition, the helicon wave plasma was generated with the generation of the magnetic field by throwing the current into the coil installed outside of the chamber. Moreover, strength of the magnetic field was changed by changing the current, and the characteristic to strength of the magnetic field was measured. And, luminescence from those plasma was observed with ICCD camera. Moreover, the effect of the electronic heating of the helicon wave was observed by measuring one cycle of the high frequency every time. And, it analyzed based on the result, and the speed of the drift was calculated from the temporal alteration. In addition, the electric field and the electronic density were able to be obtained from the calculation as a result.

Next, the experiment that used the Langmuir probe was conducted. The probe was inserted from the chamber side, and tried in this experiment to observe the high frequency propagated to the magnetic field by using the probe. And, the high frequency that had been propagated according to the magnetic field was observed by moving the probe to horizontal direction at each position. Moreover, "Spatially limited ion acoustic wave activity in low-pressure helicon discharges, C. S. Corr, N. Plihon, P. Chabert, O. Sutherland and R. W. Boswell, Physics of Plasmas, Vol. 11, and No. 10 and 2004" was read as a thesis concerning this experiment.

It compared it by observing the propagated high frequency with a horizontal density distribution. And, there was no correlativity between injected electric power and density or it tried to obtain it. Moreover, it tried to obtain a characteristic not only horizontal direction but also axially because the probe was inserted from the lower side of the chamber.

In the laboratory, the laboratory meeting was done on Tuesday every week, and the seminar was held every Friday. I also was going to participate in the meeting and the seminar as a member in the laboratory, and was able to happen to be in the place with which it discussed it about these results. It was very studied to participate in these. In addition, the seminar held on Friday also participated by not only the

student who belonged to the Czarnetzki professor's office but also the student who belonged to the Soltwisch professor's office and was held. Therefore, I thought that being able to know other research content concerning the plasma done excluding the laboratory to which I had belonged here was a good chance.

It is felt that being possible to participate in the conference for the research expenses acquisition was a very good experience in Germany. The poster session to the examiner was done for this conference. Of course, because this conference was very important, painstaking preparations were done. I think the point to which the student also takes part in a sitting as a point that especially remained in the impression at this conference for the research expenses acquisition to be enumerated. Therefore, I also remember not only doctor's student but also the student of the master's course what research you actually do appealing hard. I was able also to see various research contents at the rule university. Moreover, there was a chance of the discussion by examiners and students excluding teachers, too. Impression was received to the insistence whether to allow the student to do a very wonderful research at the university with my idea. It is felt to be able to know by what idea and stance the student in Germany is working on the research by having obtained such a chance was to have obtained it especially by me because of this dispatch. Moreover, it is felt that life in foreign countries in which it lasts being able the discussion by experimenting on both, and using English, and as many as two months also obtained the precious lesson in my future.

Moreover, the culture and the history of Germany were learnt on not only the research but also holiday, and it was possible to experience. It was possible to participate in the festival held in the German west from of old for the period when it had stayed.

This festival is held from Thursday to Tuesday the middle of February, and, meanwhile, the school and the bank, etc. become the rests. The band and the float that disguised it were parading in the carnival. The cake etc. were reeled by people on the float while a lot of one having talked about the politician and economy ironically there in the float, and shouting, "Helau". Especially, the carnival held by "Dusseldorf", "Koeln" of the big city in the region to which

we were sent, and "Mainz" is called German three large carnivals. I was also Czarnetzki professor's recommendation, and went to Dusseldorf to see the carnival with friends who had gotten acquainted in the dispatch destination. Moreover, after the Industrial Revolution, the Bochum city where the rule university is a part of the rule industrial zone where the industry of Germany has been supported. Then, it was recommended by the student in the laboratory, and it went to Germany Mining Museum in the Bochum city. As for this museum, it was built on an old coal mine, and the mark in be able proceeded actually colliery was preserved under the soil.

The appearance of the development of the history and the machine of the people who worked at the colliery where the industry of Germany had been supported had been exhibited in detail here. The current also had the chance to see the appearance etc. of the development of industry in Japan in the museum in Japan. However, I think that it was a precious lesson that was able to see the appearance of the development of the civilization in Europe where the Industrial Revolution occurs though there is Germany when the delay is taken compared with Britain etc.

I feel that very significant time was able to be spent for the period of two this months in Germany. It is because the helicon wave plasma was able to be researched firmly with Yusuf of a wonderful friend who is the co investigator. Furthermore, it seems that living in the apartment for two months in not only the research but also foreign countries, and having lived were the precious lessons for me. Moreover, the friend was able to do in Germany through life, and the culture and the history of Germany and Europe were able to be studied.

I was going to have participated in the short-term dispatch program of ITP last October, participated in the plasma school in Europe, and was able to spend significant time. Therefore, it hoped strongly to participate in this long-term dispatch. Consequently, this program was able to be spent significantly though it was substantially and greatly different from a short-term dispatch because it participated in the long-term dispatch program, it belonged to the laboratory of the rule university, and it researched, too. And, we want to express our gratitude to the Czarnetzki professor and Nagoya University plasma engineering research center ITP

secretariat of the rule university that gives such a chance. I want to tell how to add life in foreign countries telling juniors the experience of this time by all means, and deepens of the exchange with an overseas researcher again.