

Report on MERIT Long-term Overseas Dispatch Program

47-157012 Keisuke Matsuura

Department of Advanced Materials Science, the Frontier Sciences

ABSTRACT OF MY RESEARCH PROGRAM

Research Period: Oct. 2nd, 2015 – Dec. 24th, 2015

Research Institute: Hochfeld-Magnetlabor Dresden, Helmholtz Zentrum Dresden Rossendorf
(Dresden High Magnetic Field Laboratory, HZDR)

Supervisor: Dr. Sergei Zherlitsyn

Research Project: Ultrasound Investigation on the Quantum Critical Point

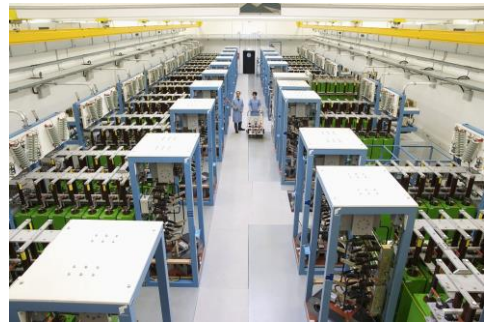
I. RESEARCH

HZDR is one of the research laboratories in Germany, belonging to the largest scientific organization Helmholtz Association of German Research Centers. High magnetic field laboratory (HLD) at HZDR has 18 capacitor banks, each of which can store large amount of electrostatic energy ~ 2.88 MJ. In addition, the pulse width of magnetic field reaches to about 0.15 s at 70 T. Dr. S. Zhelitsyn is an expert on ultrasound measurement and pulse magnet design.

He has combined these kinds of technique and developed there the ultrasound velocity measurement

system under pulsed high magnetic field ~ 70 T and at low temperature down to 1.3 K. Ultrasound measurement under such extreme but attractive conditions can be performed only here in the world. He has investigated the various phase transition and critical phenomena of magnetic materials by this technique. We had not met each other before I went there. In spite of that, he readily accepted my stay.

In order to learn the ultrasound measurement technique and conduct the measurement of some selected sample with quantum critical point, I decided to go there. I performed the experiment with the help of Dr. S. Zhelitsyn and P. T. Cong. The obtained results were discussed with them, and in the group meeting every week. For pulsed magnet experiment, in principle, we have to submit proposals to EMFL committee, but I didn't know the fact before going there. So, after discussing the theme with Dr. S. Zhelitsyn, I submitted three proposals for pulsed magnet experiment. In parallel with the pulse experiment, we performed the ultrasound measurement under static field. We encountered several troubles but finally we got very interesting results. We are now analyzing and discussing the obtained data. We hope to publish these results as papers in near future. We will promote collaborating research in the future. I learned many things from not only my experiment but also other users experiment. I also had chances to communicate with NMR, ESR, and magnetization research group in addition to



Pic. 1. Capacitor Bank in HLD

the ultrasound group.

II. LIFE DURING THE STAY

Dresden is the main city in the east part of Germany and near the Austria and Czech Republic. There are a lot of historical places, which make the cultural atmosphere in this city. In addition, we can enjoy beautiful natural scenery such as saxon-switzerland-national-park. From the end of November to December, the Christmas Market is held every year in Dresden. The Christmas Market here has the longest history in the world. I often enjoyed the market during my stay.

I stayed in the guesthouse near the laboratory. The room includes kitchen, shower room, bed and so on. We can take breakfast and lunch at the restaurant in HZDR. For dinner, we have to cook by ourselves or go somewhere. It takes about 40 - 50 minutes to get to the guesthouse from the city center by bus. The number of bus services available in a day is limited and we can take them every two hours. In my case, it was difficult for me to buy food in a working day due to the experiment. I prepared them every weekend in advance for the next week or Dr. S. Zherlitsyn often took me to the supermarket near the laboratory by his car.



Pic. 2. Christmas Market in Dresden

Events for all the laboratory members are held on a regular basis such as hiking in October, Christmas party in December and so on. Researchers come from all over the world: Russia, China, the U.S., Zambia and so on. With my colleagues, I went to tourist spots nearby Dresden on weekends. I enjoyed conversation with them and felt the cultural difference from Japan, which has deepened my view and knowledge. I was not familiar with communicating in English at first but I gradually became accustomed to using it. On the other hand, it was difficult for me to answer the questions from other people exactly, even about something related to Japan. This is the future homework for me.

ACKNOWLEDGEMENTS

I would like to express my gratitude to all the members and users of HZDR. Especially, I appreciate Dr. S. Zherlitsyn for accepting my stay at HZDR, letting me use facility and helping my life in Germany. I also thank Dr. P. T. Cong and Yulia Gritsenko for supporting my experiment. I thank Dr. H. Mitamura and S. Monbetsu for their advice of life in Germany and experiment. I appreciate Prof. T. Arima and Prof. Y. Amemiya for giving me a chance to challenge this dispatch, and MERIT program for giving me the opportunity and supporting the dispatch.