（別紙様式５）

変革を駆動する先端物理・数学プログラム（FoPM）

国外連携機関長期研修　報告書

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受入先	DESY & EPFL
日程	西暦　2025　年　6　月　18　日　～　西暦　2025　年　7　月　25　日

I visited Deutsches Elektronen-Synchrotron (DESY) in Germany for one month and the École Polytechnique Fédérale de Lausanne (EPFL) in Switzerland for a few days this summer.

In DESY at Hamburg, I attended seminars and colloquiums, had lunch with members of DESY theory group almost every weekday, and discussed physics with the members. Sometimes we talk about recent papers on arXiv at lunch. The host of my visiting was Dr. Yu Hamada, and I discussed about strong CP problem with Dr. Hamada and other members in the theory group. It was about a recent paper claiming one can only use axion-type method to solve the CP problem. Also, there was a seminar during my stay, which was about the constraints put by Big Bang Nucleosynthesis to processes that can produce neutrinos. At lunch, we discussed about that topic, and also discussed a recent paper claiming that Big Bang Nucleosynthesis can constrain baryon number asymmetry generation with large inhomogeneity. Members at DESY group told me that the paper also mentioned the possibility of using Big Bang Nucleosynthesis to constrain first order phase transition. Near the end of my stay, there was another paper on arXiv about the role of scalar perturbation accompanying bubble expansion during first order phase transition, and we also had discussion about that paper. During my stay at DESY, there was a new experimental result about detection of toponium at LHC. DESY members were in the collaboration, and they gave a colloquium to introduce this result.

I gave a seminar about my recent work at DESY. The title was “Cancellation of one-loop correction to soft tensor power spectrum”. After my seminar, we had speaker dinner at a Tibet restaurant. I had Momo, which was very delicious, and there was authentic spicy sauce in the restaurant, which was also very delicious. I was very happy. On the way toward the restaurant, I discussed about the content of my seminar and my future work with Dr. Hamada.

One of the faculty members, Dr. Thomas Konstandin, is professional on the topic of electroweak baryogenesis. Several formalisms of electroweak baryogenesis have been proposed, whereas the results are of different orders. There is not yet a consensus on this topic. I asked Dr. Konstandin for valuable advice on this topic.

I stayed at DESY hostel for the first two weeks, and stayed at an Airbnb guest room for the rest of my stay in Germany. It was the first time for me to stay with the Airbnb host together. It was an interesting experience. The Airbnb host took me to a local church to attend an activity of singing popular songs. She also cooked a traditional Hamburg dish, Labskaus, for me. She told me she will travel to Japan and China this autumn, and we can meet at Tokyo again.

I visited Dr. Mikhail Shaposhnikov at EPFL, Lausanne. It was the first time for me to go to Switzerland. I took a train from Zurich to Lausanne, because there is no airport at Lausanne. I saw many grape fields for making the wine on the train. I think it was the first time for me to see grape fields.

I gave a seminar about “Inflation and current couplings in the Einstein-Cartan gravity” at EPFL, and had many discussions with Dr. Shaposhnikov. He gave me valuable advice not only on physics knowledge but also on attitude toward physics. He is also working on the topic of Einstein-Cartan gravity, and we discussed about the content of my seminar. We also had discussion about sphaleron decoupling and baryogenesis. He is professional on the related topics and gave me valuable advice. He has a negative opinion on the possibility of generating enough baryon number only via sphaleron decoupling, even with CP source from new physics beyond the Standard Model. Also, I am interested in thermal field theory, and Dr. Shaposhnikov is very professional on thermal field theory and its application to the early universe. I asked him for advice on future projects on this topic, and he shared his opinion of his recent interests on this topic. We also discussed about hierarchy problem. He sent me many references to read on various topics we discussed, and I have many to learn and think after discussing with him.

EPFL is near Lake Geneva, and from my office I could see the lake. The weather was good, and the view

was beautiful. I went to the lake for a walk, and I could see cities and mountains along the lake. Lake Geneva was huge, and the view was amazing.

I had unforgettable experience during my stay in Europe this summer. During my stay, I had discussion on various topics with different researchers, which gave me many inspirations. I plan to have a deeper look on some of the topics, and have follow-up discussions online from Japan. I am looking forward to meeting those researchers again.

