

The Global COE Program
“The Next Generation of Physics, Spun from Universality and Emergence”
Bilateral International Exchange Program (BIEP, invite) report

Send report to: Your responsible Professor in Kyoto University

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(Year/Month/Day) 2012/10/17

Invited Student

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Responsible Researcher in Kyoto University

Name	Hideo Suganuma
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Research Project

Title	Wilson loops and renormalization
Duration	89 days

Please summarize your activities and results during your stay in Kyoto University. Also please describe how your stay has been beneficial to the graduate students in the host institute. You can add a sheet, if you need more space.

You can also write any comments and requests to the GCOE program.

After arriving to Kyoto University, the first thing I did was to present my previous work in an informal seminar. The subject was taken from my master's thesis and an upcoming paper called "Renormalization of the Cyclic Wilson Loop", in which the behaviour of heavy quarks in a plasma of quarks and gluons was studied on the basis of so-called Wilson loops, in particular a method ("renormalization") to remove undesired high energy effects ("ultraviolet divergences") from the studied low energy behaviour of a special ("cyclic") Wilson loop.

Following this presentation, Prof Suganuma and I agreed on a detailed plan for further studies in this field. In the following weeks I was working on a generalization of the method employed in my master's thesis to more general loops by studying the divergence structures of a few specially selected loops. The results were again presented as a talk in the group's colloquium series.

I discovered that these loops can indeed be renormalized by a method similar to that in my master's thesis; however, I believe that there was an oversight in one of the papers that

were the basis of my thesis. Only one of several possible cases was considered in that paper, and I think I know how to generalize that to all cases. We may possibly publish this result in the future; it has definitely led to a better understanding of these loops and divergences.

At the end of my stay, I prepared another presentation for the group's seminar. This time I explained about effective field theories, the main point of study at my home university and also a core part of my PhD thesis. Based on this and my previous studies at Kyoto, we made plans for a future collaboration between our groups which promises to bring interesting results about the behaviour of heavy quarks.

Apart from my scientific work, this visit to Kyoto University has been one of the most interesting experiences in my life. I think I learned a lot about Japan, and also about myself. In return, I tried to tell the students of Kyoto University as much as possible about Germany and Europe. Many told me that this was the first time for them to really get to know someone from outside Japan, so they were as eager to learn about where I come from as I was to learn about Japan. We had many long discussions on various topics ranging from Kanji and the Japanese education system to the European Union or classical music, to name just a few.

I believe these conversations were very fruitful to all of us, we not only learned about the other culture, but also about our own. Judging from my own experience, people rarely think about things which are taken for granted, until they meet somebody to whom this appears strange. In this way, getting in contact with another culture lets you see things from a new perspective, which may otherwise never have occurred to you.

I also think that my stay in this group has given them a good opportunity to train the English language. Having conversations in English on a daily basis certainly gives more confidence than if one does this only in special circumstances. I had the same experience, when I entered the quite international group of Prof Nora Brambilla at my home university. In addition to our everyday conversations, they listened to all my presentations in English (see above), and also presented their own work to me in English in a special seminar and other informal discussions. So they were not only training everyday English, but also speaking about scientific issues. One of the students has explicitly told me that discussing his subject in English at a conference has posed much less of a problem than before. I have also observed in the other students, that their initial hesitation to converse in English has given way to a much more relaxed attitude. I think that even if one has not yet mastered another language perfectly, losing the fear of making a mistake is instrumental in being able to have a successful conversation, and if asked I was always happy to explain details of the English language to enhance their understanding.

In these three months, we got to know each other quite well, and I believe that this will be the start of an ongoing friendship. We've promised each other to stay in contact, so this intercultural exchange will not just be a singular event, but a continuing relation. Personally, I take many very fond memories of this stay back to Germany, I was overwhelmed by the hospitality and kindness I received in Kyoto, and I am looking forward to the collaboration for which we laid the foundation in the past weeks.