

GRACE-ful students

First school for GRACE tool held at KEK

One of the most important subject in future high-energy experiments is to search and investigate the Higgs particle – the last missing piece of the Standard Model. Another important subject is the investigation of physics beyond the Standard Model such as supersymmetry. From 31 August to 3 September, the first “GRACE school”, the school for one of the important tools for quests in high-energy physics, was held at KEK in Tsukuba, Japan in cooperation with Kogakuin University.

The GRACE system is an automatic scattering amplitude generator, which enables theoretical calculations to match the required high-precision data analysis in future high-energy experiments such as the Large Hadron Collider (LHC) or the International Linear Collider. In these experiments, not only the number of reactions to treat is huge but also that of the final particles, which obviously makes hand calculations of the reaction probabilities impossible. GRACE enables physicists to achieve such large-scale calculations.

In order to realise these large calculations, GRACE uses the art of numerical calculations, like numerical integration, one of the symbolic manipulations to treat Feynman diagrams, and parallel processing techniques to accelerate the calculation speed.

Especially the ILC, because it collides elementary particles, is expected to provide very accurate data. The calculations of higher-order corrections to reactions are indispensable. GRACE has a remarkable function to treat “one-loop diagrams and more” to get a handle on it. For example, GRACE predictions allow to discriminate the right theory among many proposed ones by comparing the actual data from ILC and the GRACE computing results.

This school at KEK was aimed at graduate students who want to become either experimentalists or theorists to learn and get hands-on experience of the GRACE system. Ten graduate students just finished an intense four-day programme, ranging from lectures on the basic theoretical background for calculations and actual calculation exercises using the GRACE system, to the development of the event generating software that will be needed for data analysis.

The last day of the school, the students made a presentation on their calculation results. They all participated in some physics experiments such as LHC, Belle, or Super Kamiokande, and performed the calculation related to the experiments. “This GRACE School was a big success. Since this was the first attempt, we as the hosting scientists were sort of fumbling to find our way to go. But it turned out to be a wonderful opportunity for both students and scientists. Students were staying late to debate and work on their projects. They were very eager to learn and energetic,” said Yoshimasa Kurihara, a lecturer from the Institute for Particle and Nuclear Studies (IPNS) at KEK, president of this school. “The ILC is an international project which will take some time to organise. The participation of the younger generation is essential for the realisation of the ILC. This school was a good opportunity for them to get involved.” The next GRACE school is planned to be held next summer.

-- Rika Takahashi



GRACE school students and the lecturers smile after an intense four-day programme.