Nishina School 2024

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Nishina School aims at introducing nuclear physics research to Asian university students who are in the process of choosing their field of study. In 2024, the 15th Nishina School was held from July 25 to August 2. Students and supervisors from Peking University, the University of Hong Kong, Seoul National University, Rikkyo University, Tsukuba University, and Saitama University participated in Nishina School this year. In addition, high school students from Philips Exeter Academy, USA, along with their teachers, participated in most of the school programs. Figure 1 shows all 26 students and school staff members.

The school began with self-introductions of the students. The first week was dedicated mostly to lectures and training on several subjects related to a nuclear reaction experiment to be performed in the second week of the school. The lectures covered a few fundamental topics for research, including overviews of nuclear physics and nuclear astrophysics, and methods of radiation measurements. Other lectures were dedicated to radiation safety and network security. The training sections included electronic-pulse propagation and radiation detection, covering the detectors, electronics, and data acquisition system to be used in the experiment in the following week. During the second week, the program focused on a reaction experiment using a proton beam from the Pelletron accelerator at RIKEN Nishina Center.

The students were divided into six groups, each overseeing six different types of measurements. Each group was assisted by a mentor, a young RNC researcher. They began designing the experiment by evaluating the feasibility of measurements such as estimating γ-ray yields, setting up detectors around the reaction target, and determining the conditions of beam exposure based on their considerations. After completing the experiment, they analyzed the experimental data obtained and finally made presentations of their results. The students studied the low-energy $^{12}\mathrm{C}(p,\gamma)^{13}\mathrm{N}$, $^{10}\mathrm{B}(p,\alpha\gamma)^{7}\mathrm{Be}$, $^{27}\mathrm{Al}(p,p\gamma)^{27}\mathrm{Al}$, or $^{9}\mathrm{Be}(p,\gamma)^{10}\mathrm{B}$ reaction, related to nucleosynthesis in the Cosmos.

Fig. 1. Participants of Nishina School 2024.

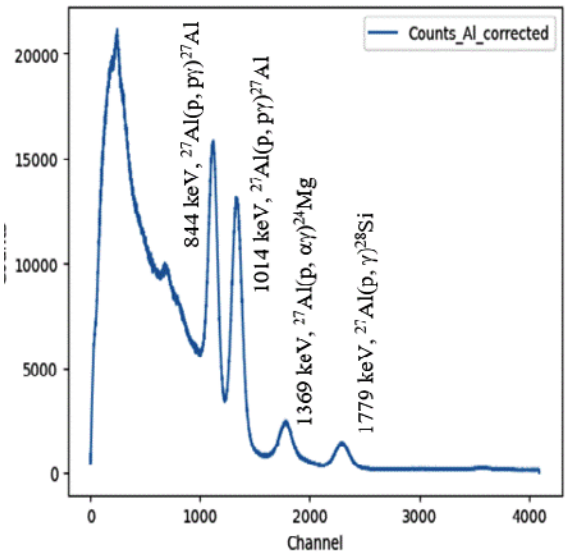

Fig. 2. Example of γ-ray spectrum in the case of Al target irradiated with 2 MeV proton beam. Peaks of γ rays were observed from $^{27}\mathrm{Al}(p,p\gamma)^{27}\mathrm{Al}$, $^{27}\mathrm{Al}(p,\alpha\gamma)^{24}\mathrm{Mg}$, and $^{27}\mathrm{Al}(p,\gamma)^{28}\mathrm{Si}$ reactions.

A proton beam with an energy of 2 MeV bombarded and stopped inside a C, BN, Al, or Be target, providing thick target yield of those reactions. The γ rays emitted from each reaction were measured with a NaI detector. Figure 2 shows an example of a measured γ-ray spectrum in the case of the Al target.

The all six groups finally extracted reaction cross sections, which reproduced previous literature values well within several 10% error.

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