Estimation of a ceiling thickness using the muography technique with a small cosmic-ray detector

*Nana Kobayashi[1]

1. Kaichi High School

Since cosmic-ray muons are shielded by the ceiling inside a building, the detection rate of penetrated cosmic-ray muons is decreased on a lower level. It has been applied as muography e.g. observation of the interior of pyramids. I estimated the thickness of the ceiling of the school building by using this technique with the handmade cosmic-ray detector and I also confirmed the consistency between the measured result and value from the drawing of the building.
First, we measured the arrival rate of cosmic-ray muons on the 1st to 5th floors of the school and in the schoolyard (0 floors) using a cosmic-ray detector so-called Cosmic Watch. Two Cosmic Watch detectors were stacked on top of each other, and only the cosmic rays that passed through both upper and lower detectors were counted to limit the solid angle to the direction perpendicular to the ground. I confirmed that the frequency of arrival of cosmic rays decreased as the floor was lowered.
Then, we simulated the correlation between the thickness of concrete, which is the main component of the ceiling, and the arrival rate of cosmic-ray muons, and compared the simulation results with the arrival rates at each floor. I obtained the path length of the cosmic-ray muons with the averaged energy of muons and the stopping power of the concrete.
The total thickness of the ceiling from the measurement was 253 cm and from the drawing was 290 cm.

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