

Experiment No. 2

Attenuation of gamma rays

Aim of the experiment:

Measure attenuation curves of gamma radiation with various photon energy, using various absorbers. Observe regularities of interaction of gamma radiation with matter: 1) the exponential attenuation law, 2) the decrease of the attenuation coefficient with increasing energy of gamma quanta, 3) the increase of the attenuation coefficient with increasing atomic number of the absorber.

Tasks:

1. Measure attenuation curves of gamma radiation emitted by nuclides ^{137}Cs (cesium-137) and ^{60}Co (cobalt-60), using aluminum, iron and lead as absorbers.
2. Plot the attenuation curves and determine corresponding attenuation coefficients.
3. Test the validity of the exponential attenuation law.

Control questions:

1. Define the main processes of interaction between gamma radiation and matter: Compton scattering, photoelectric effect and pair production.
2. Write down the exponential attenuation law. Define the concept of the attenuation coefficient.
3. Describe in general terms the dependence of the attenuation coefficient on the atomic number of the absorber and the incident photon energy.

Recommended reading:

1. Krane K. S. Introductory Nuclear Physics. New York: John Wiley & Sons, 1988. p. 198 – 204, 217 – 220, 392 – 394.
2. Lilley J. Nuclear Physics: Principles and Applications. New York: John Wiley & Sons, 2001. p. 24 – 25, 136 – 142.
3. Knoll G. F. Radiation Detection and Measurement. 3rd Edition. New York: John Wiley & Sons, 2000. p. 48 – 55.