Gamma Spectroscopy – Instruction Notes

Keywords: radioactive decay, gamma - photons, beta decay, neutrino, Compton effect, multi-channel analyzer

I. GOALS OF THE EXPERIMENT

The experiment is intended to provide information on the origin, type and detection of radioactive radiation, whereby only γ – rays are experimentally treated. Additionally, the handling of radioactive samples and measuring instruments will be practiced.

II. LEARNING CONTENT

- nuclear models
- nuclear transformations, nuclear rays
- detection of nuclear rays
- interactions of gamma - rays with matter
- scintillation and semiconductor detectors for gamma rays
- single and multi - channel analyzers
- working with radioactive samples

III. PROCEDURE

This experiment is subject to the radiation protection ordinance, therefore precise knowledge of this regulation is required. This was presented by the radiation protection officer at the introductory safety briefing. Without this instruction, the experiment must not be carried out. It is possible and recommended to examine a spectrum of a radioactive mineral, a technical product (old clock with luminous numbers, "radiant" bathroom tile or similar). These materials should be brought by the groups themselves. Documents on the instruments and radiation protection are available by request at the advisor.

FIRST LAB SESSION

- introduction to gamma - spectrometry
- calibrate the multi-channel analyzer
- record the energy spectra of known emitters (^{137}Cs, ^{60}Co, ^{226}Ra, ^{241}Am, ^{90}Sr) with the Ge or GeLi detector
- record the energy spectra of unknown samples

SECOND LAB SESSION

- measurements with NaJ scintillation detectors
- absolute determination of the absorption coefficient of Pb with the ^{137}Cs source

- angle dependent Compton scattering: measure the energies of the scattered photon and electron
- record the energy spectra of unknown samples and of technical products.

IV. REFERENCES:

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