

Scintillation

Summary

In this experiment the students will learn the basic concepts of radioactive emission, its interactions with matter and its detection via a scintillation crystal and a photomultiplier. The students will also familiarize themselves with the measurement of the gamma spectrum of radioactive sources using a scintillation detector. The basic goals are to calibrate the multi-channel analyzer (MCA), find the system's dead-time, and finally to analyze the spectrums of ^{137}Cs , ^{22}Na , ^{60}Co and neutron-activated aluminum foil (created using the neutron source $^{241}\text{Am}/\text{Be}$).

Theoretical and Technical Literature

Material for the experiment is almost completely covered in the book: “**Radiation Detection and Measurement**” by **Glen F. Knoll**. The topics and their relevant chapter in the book are listed in the following table:

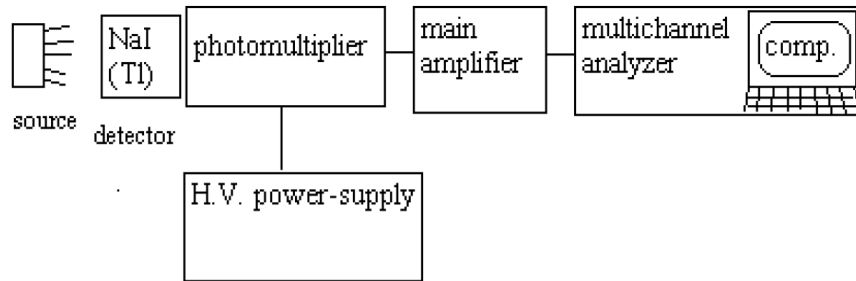
Topic	Chapter	Sections	
		Required for entry quiz	Required for report and final exam
Radiation sources	1	whole chapter	
Radiation interactions	2	Intro, II, III, IV	
Counting statistics and error prediction	3		whole chapter
General properties of radiation detectors	4	whole chapter	
Scintillators, specifically NaI(Tl)	8	Intro, II (A, B1), III (A)	
Photomultipliers	9	Intro, I-V, VII	
Radiation spectroscopy with scintillators	10	Intro, I, II, III	IV, VI
Multi-channel analyzer	18	Intro, I, II	
Neutron activation	19	X (A, B)	

Additional sources are given at the end of this document. A collection of manuals for the equipment used in the experiment is available in electronic format (ask guide).

Experiment Goals

1. Calibrate the voltage for best resolution and the MCA's channel-energy conversion.
2. Measure the detector's dead-time using the two-source method.
3. Measure and analyze the spectrums of the radioisotopes ^{137}Cs , ^{22}Na and ^{60}Co .
4. Measure and analyze the products of neutron-activated Aluminum.
5. Expansion experiment.

Scheme of the Experimental Setup



References

- [1] Radiation Detection and Measurement - Glen F. Knoll
- [2] The Atomic Nucleus - Robley D. Evans