Absorption of γ radiation (P 6.5.5.3)

P 6.5.5

γ spectroscopy

P 6.5.5.1 CASSY-S Detecting γ radiation with a scintillation counter

P 6.5.5.2 CASSY-S Recording and calibrating a γ spectrum

P 6.5.5.3 CASSY-S Absorption of γ radiation

P 6.5.5.4 CASSY-S Identifying and determining the activity of weakly radioactive samples

P 6.5.5.5 CASSY-S Recording a β spectrum using a scintillation counter

P 6.5.5.6 CASSY-S Coincidence and γ-γ angular correlation in positron decay

Cat. No.	Description	P 6.5.5.1	P 6.5.5.2	P 6.5.5.3	P 6.5.5.4	P 6.5.5.5	P 6.5.5.6
559 84	Mixed preparation α, β, γ	1					
559 83	Set of 5 radioactive preparations		1	1		1	1
559 885	Calibrating preparation 137 Cs, 5 kBq				1		
559 901	Scintillation counter	1	1	1	1	1	2
559 912	Detector-output stage	1	1	1	1	1	2
559 94	Set of absorbers and targets			1		1	
559 89	Scintillator screening				1	1	
559 891	Socket for scintillator	1	1	1	1	1	1
559 88	Marinelli beaker				2		
521 68	High voltage power supply 1.5 kV	1	1	1	1	1	2
524 010USB	Sensor-CASSY	1	1	1	1	1	1
524 058	MCA Box	1	1	1	1	1	2
524 200	CASSY Lab	1	1	1	1	1	1
575 211	Two-channel oscilloscope 303	1*					
501 02	BNC cable, 1 m	1*					
300 42	Stand rod, 47 cm	1	1	1		1	1
301 01	Leybold multiclamp	1	1	1		1	1
666 555	Universal clamp, 0...80 mm dia.	1	1	1		1	1
672 5210	Potassium chloride, 250 g				4		
	additionally required: PC with Windows 95/NT or higher	1	1	1	1	1	1

* additionally recommended

When interpreting γ energy spectra recorded with a scintillation counter, it is necessary to take several interactive processes of the γ radiation with the scintillator crystal into consideration. In the photoeffect, the γ quanta transfer their entire energy to the crystal and are registered in the total absorption peak. Due to Compton scattering, it often occurs that only a part of the γ energy is transferred to the crystal, as there is a certain probability that the scattered γ quantum will exit the crystal. The γ quanta are registered in a continuous distribution in which the upper and lower limits are determined by the maximum and minimum energy which can be transferred to the electron in Compton scattering. A third possible interaction, pair formation, is only significant at γ energies above 2 MeV.

In the first experiment, the output pulses of the scintillation counter are investigated using the oscilloscope and the multichannel analyzer MCA-CASSY. The total absorption peak and the Compton distribution are identified in the pulse-amplitude distribution generated with monoenergetic γ radiation.

The aim of the second experiment is to record and compare the γ energy spectra of standard preparations. The total absorption peaks are used to calibrate the energy of the scintillation counter and to identify the preparations.

The third experiment examines the attenuation of γ radiation in various absorbers. The aim here is to show how the attenuation coefficient μ depends on the absorber material and the γ energy.

A Marinelli beaker is used in the fourth experiment for quantitative measurements of weakly radioactive samples. This apparatus encloses the scintillator crystal virtually completely, ensuring a defined measurement geometry. Lead shielding considerably reduces the interfering background from the laboratory environment.

The final experiment records the continuous spectrum of a pure β radiator (Sr-90/Y-90) using the scintillation counter. To determine the energy loss *dE/dx* of the β particles in aluminum, aluminum absorbers of various thicknesses x are placed in the beam path between the preparation and the detector.