

Atomic and nuclear physics

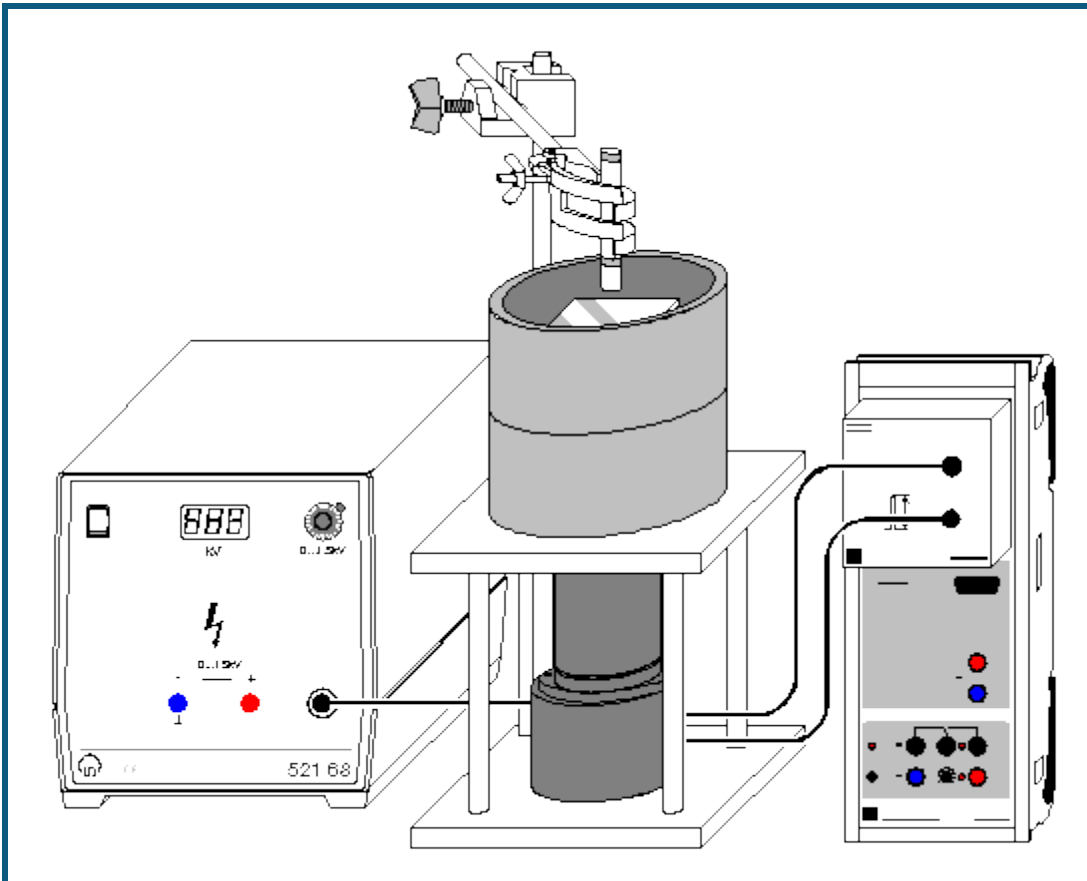
Nuclear physics
 γ spectroscopy


Recording a β spectrum
with a scintillation counter

Description from CASSY Lab 2

For loading examples and settings,
please use the CASSY Lab 2 help.

Recording a β spectrum using a scintillation counter



 can also be carried out with [Pocket-CASSY](#)

Safety note

When handling radioactive preparations, in addition to the radiation protection regulations, state-specific requirements and the regulations of the educational authorities are also to be observed, e.g. in the Federal Republic of Germany at the very least the radiation protection regulations (StrlSchV - Strahlenschutzverordnung) and the directives on safety during school lessons. The preparations used in this experiment are type approved according to StrlSchV (2001) or they are below the exemption limit and do not require approval. For this reason handling without express permission is possible.

Since the used preparations produce ionizing radiation, the following safety rules must nevertheless be kept to:

- Prevent access to the preparations by **unauthorized persons**.
- Before using the preparations make sure that they are **intact**.
- For the purpose of **shielding**, keep the preparations in their safety container.
- To ensure **minimum exposure time** and **minimum activity**, take the preparations out of the safety container only as long as is necessary for carrying out the experiment.
- To ensure **maximum distance**, hold the preparations only at the upper end of the metal holder.

Experiment description

The β spectrum of Sr-90 is recorded with a scintillation counter. The energy loss per path length dE/dx of the β particles in aluminum is measured.

Equipment list

1	Sensor-CASSY	524 010 or 524 013
1	CASSY Lab 2	524 220
1	MCA box	524 058
1	Set of radioactive preparations	559 835
1	Na-22 preparation	559 865


1	Set of absorbers and targets	559 94
1	Scintillation counter	559 901
1	Detector output stage	559 912
1	High-voltage power supply 1.5 kV	521 68
1	Scintillator screening	559 89
1	Socket for scintillator screening	559 891
1	Stand rod, 47 cm	300 42
1	Leybold multiclamp	301 01
1	Universal clamp, 0...80 mm	666 555
1	PC with Windows XP/Vista/7/8	

Experiment setup (see drawing)

The output stage of the scintillation counter is connected to the MCA box and to the high-voltage power supply. The scintillation counter is mounted in the socket from above with the lead screening. The acrylic glass tube is put over the scintillation counter within the lead screening. The preparation is placed a few centimeters above the scintillation counter with stand material. The absorber plates are laid on the acrylic glass tube so that they are located between the detector and the preparation.

Carrying out the experiment

■ Load settings

- Mount the [Sr-90](#) preparation, and record the spectrum with . Set the high voltage so that the spectrum is not cut off on the right side.
- For the [energy calibration](#), mount the [Na-22](#) preparation, and calibrate the energy axis with the 511 keV and the 1275 keV line. The Sr-90 spectrum extends to approx. 2000 keV.
- It is recommendable to determine the background without preparation.
- Mount the Sr-90 preparation once more, and see to it that there is enough space for the absorbers.
- One after another record the spectra without absorber, with a 0.5 mm thick aluminum absorber, 1 mm aluminum, and so on up to 3 mm aluminum.

Evaluation

The aluminum absorber reduces the maximum energy of the electron reaching the detector. The highest energy of each Sr-90 spectrum at which electrons are detected is determined. These energies are compiled in a table together with the corresponding thickness of the absorber. The slope of the regression line gives the energy loss per path length dE/dx , which, in this case, amounts to about 400 – 450 keV/mm.