

Atomic and nuclear physics

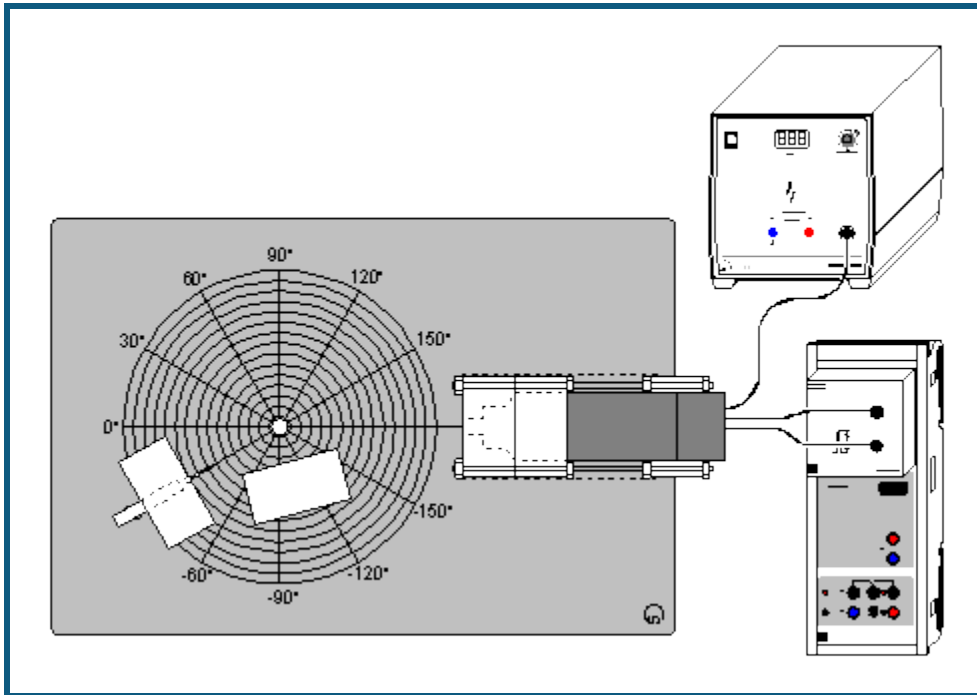
Nuclear physics
Compton effect

Quantitative observation of
the Compton effect

Description from CASSY Lab 2

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

Quantitative observation of the Compton effect



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 preparation used in this experiment requires official permission! Before purchase, the radiation officer has to obtain permission from the authorities.

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

An energy calibration of the scintillation counter is made. The energy distribution of γ quanta scattered in an aluminum scatterer is recorded for several angles between the source and the detector. From this the quantitative confirmation of the Compton effect is obtained.

Equipment list



1	Sensor-CASSY	524 010 or 524 013
1	CASSY Lab 2	524 220
1	MCA box	524 058
1	Mixed preparation α, β, γ	559 845 or 559 835
1	Equipment set Compton	559 800
1	Cs-137 preparation, 3.7 MBq	559 809 (requires permission)
1	Scintillation counter	559 901
1	Detector output stage	559 912
1	High-voltage power supply 1.5 kV	521 68
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 experiment panel from the Equipment set Compton is put down and the lead screening set up correspondingly.

Carrying out the experiment

■ Load settings

- First make an [energy calibration](#) of the scintillation counter. For this insert the mixed preparation in the sample holder from the Equipment set Compton, align it at the 0° mark. Leave the aluminum scatterer aside.
- Record the spectrum with , and make the energy calibration with the lines at 662 keV and 59.5 keV.
- Replace the mixed preparation with the [Cs-137](#) preparation, set up the preparation at 30°, and set up the aluminum scatterer. Place the additional screening in the direct line of vision between the preparation and the detector.
- Record the spectrum with , then remove the aluminum scatterer, and record a new spectrum.
- The difference between the two spectra (with and without the aluminum scatterer) is the scattering spectrum.
- Repeat the measurement at various angles of the preparation, each time subtracting a spectrum without the aluminum scatterer from a spectrum with the aluminum scatterer. Always shift the additional screening in the setup so that the direct line of vision between the preparation and the detector is blocked.

Evaluation

From the scattering spectra (difference with and without aluminum scatterer) the energy of the scattered γ quanta is determined. The values are plotted against the associated angles and compared with the theoretical values:

$$E'_{\gamma} = E_{\gamma} / \left(1 + \frac{E_{\gamma}}{m_0 c^2} (1 - \cos \theta) \right)$$

Alternatively a [Free fit](#) can be performed.