Gamma spectroscopy is a method that can be used to identify different radioactive isotopes. Gamma-rays are emitted by the relaxation of an excited nucleus from an excited state. In a similar fashion to atomic electron relaxation, these gamma-rays are released at specific energy levels for a given nucleus. By measuring the energy levels of gamma-rays emitted from a source material, these values may be compared with known energy values and used to identify the atomic nucleus of the source material. In this experiment, a sodium-iodide (NaI) scintillation detector was used to measure the energies of gamma-rays emitted by known several materials. The data collected from these known isotopes was used to set a calibration curve. An unknown compound of two different isotopes was measured and plotted on the calibration curve in order to determine the energies of its emitted gammas. These found gamma energies were then compared with known gamma ray energies rules out the unknown sources Cs-137 and Zn-65 through a gamma ray database analysis.

In this experimental setup, a spectrometer with a lead-shielded scintillator and photomultiplier tube (PMT) is employed to analyze seven radioactive sources, including an unknown mixed source. The gamma rays emitted by these sources undergo processes like Compton scattering, pair production, and photoelectric absorption within the scintillating crystal and are then amplified in an exponential series of electrons through the photomultiplier tube. The resulting pulses are detected, and the software generates a graph of counts verses channel number. Calibration involves accommodating all energy peaks, with their Gaussian fit, from the known sources first and then placing them on a calibration curve to help identify the unknown sources. The calibration curve establishes a relationship between channel numbers and energy levels. Comparing the unknown source’s energy peaks to known gamma ray energies, along with their uncertainties, rules out the unknown sources Cs-137 and Zn-65 through a gamma ray database analysis.

Gamma spectroscopy is a method that can be used to identify the nuclei present in different radioactive materials. Gamma-rays are emitted as a result of the relaxation of an excited nucleus back down to a lower energy state; where a gamma-ray’s energy corresponds to the difference between a given nucleus’ energy states. Since these energy states are determined by the composition of a particular atom, a gamma-ray released by a given nucleus will have specific energies. In this experiment, a sodium-iodide (NaI) scintillation detector was used to measure the energies of gamma-rays emitted by known several materials. The data collected from these known nuclei was used to set a calibration curve. A final compound of two different, unknown nuclei was measured. Lastly, the calibration curve was used to determine the energies of the gammas emitted by the unknown nuclei. The energies were then compared with a catalog of known gamma-ray energies in order to identify the unknown nuclei: Cs-137 and Zn-65.