PHOTON EMISSION INTENSITIES IN THE DECAY OF U-235

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Introduction

Uranium-235 is the parent of one of the natural radionuclides decay series and appears in the background of any spectrometer and is also classified as a NORM (Naturally Occurring Radioactive Material).

Uranium-235 decay is characterized by about fifty gamma-rays with E > 450 keV, most of them with weak emission intensities (< 1%).

Probably due to the weak specific activity of U-235 and its presence in any background measurement, only a few experiments have been conducted to measure the photon emission probabilities associated to the U-235 decay.

Recommended values are based on the intensity of the 185.72 keV gamma ray, used to normalize relative measurements.

Gamma-ray spectrometry

Measurements performed using high-purity germanium detector. Source at 10 cm from the detector window.

Results

For each peak with energy , the absolute intensity, is computed as:

Relative standard uncertainty.

Due to the equilibrium between U-235 and Th-231 it was also possible to determine some photon emission intensities associated to the decay of Th-231.

Conclusion

The relative photon emission intensity (185.72 keV) is obtained with 1.28% relative combined uncertainty. Most of the present results agree with the tabulated data. Some discrepancies are noticed in the 70-keV and 90-keV energy regions: the complex spectrum structure with gamma- and K X-rays from different nuclides, together with the strong influence of the background and uranium self-fluorescence make it difficult to unambiguously attribute the counting to individual lines.

It is expected that these new experimental values will provide helpful information for future evaluation of the decay schemes of U-235 and Th-231.