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Half-life determination of isomers produced by spontaneous fission of 252Cf using the VESPA setup

At EC-JRC Geel, the VESPA setup [1], made of a position-sensitive double Frisch-grid ionization chamber surrounded by $LaBr_3$(Ce) scintillation detectors, is dedicated to multi-parameter measurements on ^{252}Cf(sf). The fission process generates highly excited nuclei. These nuclei will dissipate their excitation energy and angular momentum through the emission of neutrons, photons and conversion electrons. During this de-excitation process, they may populate an isomeric state characterized by its half-life.
Using five $LaBr_3$(Ce) detectors, several gamma-ray transitions, originating from isomeric states, were detected and their associated half-lives were measured. As lanthanum-bromide detectors are fast scintillators [2], they are well suited to perform such measurements. However, many gamma rays are emitted during the fission process, and the resolution of such scintillators is not sufficient to discriminate background from the gamma rays of interest. Thus, coincident γ-γ events were considered in order to lower the background.
The identification of the emitting nuclei was performed using the mass information that is obtained from the ionization chamber signals, together with the spectral characteristics of the gamma rays, namely their energy and time distribution relative to fission. In the end, the half-life of several isomeric states were measured, including the 830.83 keV state of ^{97}Sr, where previous measurement lead to discrepant data [3]. The range of measured half-lives in this work goes from a few nanoseconds up to a few microseconds.

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