

## Investigation of rare nuclear decays - double gamma decay

Double-gamma decay is a rare nuclear decay process, firstly investigated in 1930 by Maria Goeppert in her doctoral thesis. In double-gamma decay, an excited nuclear state decays over an intermediate virtual state to a lower-lying state and emits two photons in coincidence. Sum energy of the two photons is equal to the transition energy. Probability of the two photon decay involves summing of all possible 'paths', which can be connected by initial and final states. This makes the two-photon decay probability an excellent tool to check the nuclear structure properties.

So far this mode of decay was observed in nucleus  $^{90}\text{Zr}$ ,  $^{40}\text{Ca}$ ,  $^{16}\text{O}$ , for which single photon decay is forbidden ( $0^+_{2} \rightarrow 0^+_{1}$  transitions). Up to day only in one case for  $^{137}\text{Ba}$   $\gamma\gamma$  competitive to  $\gamma$  was observed.

The aim of this project is to investigate competitive  $\gamma\gamma$  decay of nuclei to find a way to measure the two-photon decay properties in case when single decay is not forbidden. This will provide the new tool to investigate nuclear structure properties.

This will be done with use of state of the art scintillator based phoswich detectors from PARIS collaboration (<http://paris.ifj.edu.pl>).