Conversion Electron Measurements in the 2nd Minimum of ^{240}Pu

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A new experimental facility for conversion electron measurements was set up at the Munich Tandem Accelerator. The electron spectrometer consists of 3 magnetic transport systems called Mini-Oranges, which were developed by J. van Klinken [1]. An orange type configuration of permanent magnets around a central absorber can separate electrons from α, β, γ and δ- radiation. Only conversion electrons in a narrow energy range can pass through the permanent magnetic field and get detected by a Si-Li solid state detector positioned behind the absorber. By varying the number, thickness and material of the permanent magnets as well as the distances between the target and the Mini-Orange , the Mini-Orange and the SiLi-detector, respectively it becomes possible to optimize the configuration for different energy ranges. Our first measurement with the spectrometer aimed at conversion electrons emitted from excited states in the second minimum of ^{240}Pu. γ-spectroscopic measurements of the states using the new Cluster detectors have already been made at the MPI Heidelberg [2]. In the reaction ^{238}U(α,2n)^{240}Pu with E_α=25MeV predominantly a single γ-line at 785 keV was observed, which occured in about 40% of all decays of the fission isomer. Since the Alaga-rule predicts in most cases a population of several rotational levels with comperable strength, the occurence of a single very intense γ-line leads to the expectation that the excited level in the second minimum has spin 0^+ and might in addition be accompanied by a strong $0^+ \rightarrow 0^+$ transition at 806 keV. In order to detext the transition the arrangement of the experiment shown in fig. 1 was used.

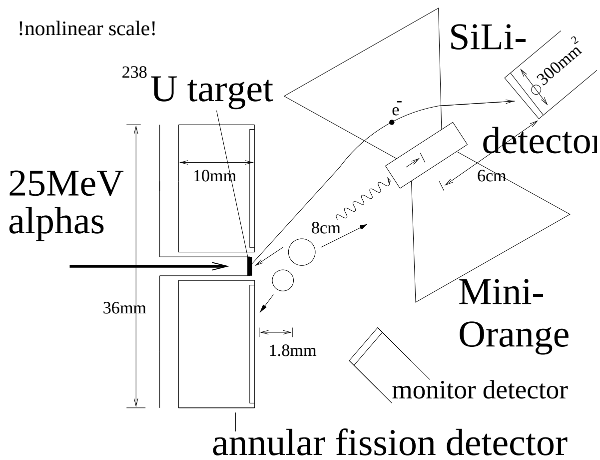

Fig. 1: Experimental setup showing one of the 3 installed Mini-Oranges and the target positioned inside the hole of the annular detector

A target of 20μg/cm^2 ^{238}U evaporated on a 10μg/cm^2 C backing is sitting in the 4 mm diameter hole of an annular semiconductor detector. 25 MeV alpha particles populate the states of ^{240}Pu by the ^{238}U(α,2n) reaction. The fission fragments from the 3.8 ns isomer are seperated from the intense prompt fission by using the recoil shadow technique. Only the fragments of decays occuring in front of the target can reach the fission counter. From 8600 delayed fission events, the electron and time spectra in fig. 2 were extracted.

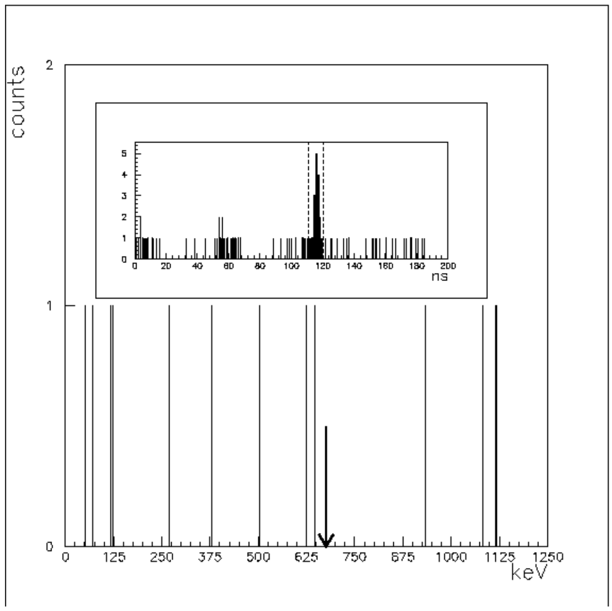

Fig. 2: Energy spectrum of 1 electron detector and the according time spectrum inserted

The spectrum shows the energy spectrum of the electron detector from true coincidence events between the fission and the electron detector. With an efficency of 1% for the electron detector and no detected electrons of the K-line at 683 keV the branching ratio $I(E0,806keV)/I_\gamma(785keV)$ is less equal 3% and doesn't agree with the expected ratio of 20-40%, which should have resulted in 20 events at 683 keV. With an increased detection efficency of 10% in a future experiment, it must be possible to detect the conversion coefficient of the 785 keV γ-line.

References

[1] J. van Klinken and K. Wisshak, Nucl. Instr. Meth. **98** (1972) 1
[2] D. Pansegrau, Ph.D. thesis, MPI Heidelberg, 1997