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ALBEGA: A decay spectroscopy setup for chemically separate d samples


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There are many on-going programmes dedicated to elucidate the nuclear structure of SuperHeavy Elements (SHE atomic number Z ≥ 104) based on different methods [1]. The SHE are accessed in heavy-ion induced fusion-evaporation reactions, with the nuclear spectroscopy experiments typically performed at in-flight recoil separators.

An alternative approach exploits a chemical isolation system either directly or after separator [2], this was adopted in different experiments [3-5]. A significant improvement of the background conditions was observed applying this method.

A next generation setup for measurements of ALpha-Beta-Gamma decays (ALBEGA) after chemical isolation was recently built. ALBEGA is dedicated to simultaneous measurements of α particles, electrons, photons and γ rays. All the detectors were assembed in a packed configuration to maximize the geometrical efficiency.

The setup was first tested and calibrated with α particles and γ rays produced by decay chains of 219Rn emanated from an 227Ac source. Then the 140Ce(50Ti, 6-7n) reaction was used to produce 184,185Hg, which was preseparated in TASCA [3] and then transported to ALBEGA with rapidly flowing of Ar gas. The energy spectrum and the distribution pattern observed in the experiment (c) is due to the Hg retention on the inner channel Au coating, and the maximum is observed on the segments at the channel entrance.

References


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Figure 1: A schematic of ALBEGA, where the arrows indicate the gas flow inside the tight channel (a). A picture of the α detector mounted on the cooling support and connected to the capillaries for gas flushing.

Figure 2: The α particles are emitted isotropically at various angles in the narrow channel (a). Depending on their incident angle, they pass through different effective thicknesses of detector dead layer and gas, thus undergoing energy loss to a different degree, before entering the active detector area. Accordingly, α peaks show characteristic low-energy-tailing, e.g. the 140Ce(50Ti, 6-7n) reaction energy spectrum (b). The measured energies corresponding to the two particles α1 and α2 are indicated, they have the same initial energy but different path. The distribution pattern observed in the experiment (c) is due to the Hg retention on the inner channel Au coating, and the maximum is observed on the segments at the channel entrance.