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Investigation of ternary particles in the spontaneous fission of 252Cf

This work investigates the light charge particle (Z = 1 to 6) in the spontaneous fission of 252Cf. A position-sensitive ΔE-E telescope with excellent energy resolution was employed to identify and characterize the emitted particles. Transmission-type ΔE detectors from Micron Semiconductor, with thicknesses of 16 μm and 150 μm, are used for specific energy loss (ΔE) measurements. Timepix detectors, in thicknesses of 300 μm and 600 μm, measures the residual energy (E) of the emitted particles. Partial-energy spectra for the different ternary particle types were obtained due to the placement of aluminum foils (30 μm) and ΔE detectors (16 μm and 150 μm) in front of the E detectors. The detector system achieves sufficient resolution to discriminate protons (^{1}H), deuterons (^{2}H), tritons (^{3}H), ^{3}He, and ^{4}He isotopes clearly.

Gaussian fitting of the measured partial-energy spectra allowed for the extraction of yield and energy information for each identified particle type. However, the ^{1}H spectrum required additional analysis due to potential contributions from background reactions such as Al(α, p), Al(n, p), and Si(n, p). The Talys nuclear reaction code was employed to quantify these contributions specifically for hydrogen. The calculations confirmed the presence of ^{1}H from the Al(α, p) reaction within the measured energy range. Background-free energy spectra were obtained by subtracting the calculated spectra from the experimental data. Gaussian fitting approach allowed to determine yields and kinetic energies for a broad range of light particles emitted during ternary fission of ^{252}Cf, including ^{1}H, ^{2}H, ^{3}H, ^{4}He, ^{3}He, ^{6}He, ^{8}He, Li, Be, B, and C.

Section

Nuclear physics (Section 1)

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