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Neutron multiplicity distributions for 250No spontaneous fission from ground state or at the decay of the isomeric state

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The spontaneous fission is one of the decay channel on a par with α- and β+-decays for heavy and super-heavy isotopes (Z > 100). There are no established models that could describe all details of spontaneous process well yet. Therefore, experimental studies of such processes are high-interesting and important.

The combination of relatively high formation cross-section in complete fusion reactions and discovered K-isomer state living longer than its ground state [1] makes 250No isotope attractive to experimental study. The SHELS separator [2] and SFiNx detection system [3] at FLNR JINR, Dubna, Russia allows us carrying out experiments to study prompt neutron yields from 250No spontaneous fission.

The previous experiment [4] hinted at possibility of spontaneous fission directly from an isometric state 250mNo. The difference between average numbers of neutrons per fission with corresponding lifetimes (for ground and isometric states) was quite large but statistically insignificant (≈2σ). Thus, conclusion about spontaneous fission from isomeric state possibility couldn't be drawn.

In the beginning of the 2022 the new experiment was carried out using modern analysis techniques and the detectors array with higher efficiency than in the previous one [4]. Approximately 1350 spontaneous fissions of 250No were registered (vs ≈700 in [4]). Two activities with different lifetimes associated with 250No and 250mNo were observed. The difference between average numbers of emitted spontaneous fission prompt neutrons for both activities are statistically insignificant (<1σ). Prompt neutrons multiplicity emission probability distributions for both activities separately and combined were restored using statistical regularization method [5].

The prompt neutron multiplicities distributions restoring technique will be discussed in the report. Furthermore, the structure of such distributions will be shown in conjunction with theoretical interpretation of processes.

1. J. Kallunkathariyil et al., Phys. Rev. C 101, 011301 (2020)
2. A.G. Popeko et al., NIMB, 376, 140-143 (2016)
3. A.V. Isaev et al., Phys. of Part. and Nucl. Let., 19, 1 (2022)
4. A.I. Svirikhin et al. Phys. of Part. and Nucl. Let., 14, 4 (2017)
5. R.S. Mukhin et al., Phys. of Part. and Nucl. Let, 18, 4 (2021)

The speaker is a student or young scientist

Yes

Section

1. Nuclear structure: theory and experiment

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