Contribution ID: **263** Type: **Oral**

Experimental Investigation of Mass and Total Kinetic Energy Distributions of Fragments Formed in the ^{48}Ca + ^{208}Pb Reaction

Wednesday 2 July 2025 15:30 (20 minutes)

The ^{48}Ca + ^{208}Pb reaction is distinguished by its unique combination of advantages in heavy-ion fusion studies, as both interacting partners are doubly magic nuclei. Moreover, the ^{208}Pb target provides a cold fusion pathway, while the neutron-rich ^{48}Ca projectile provides a significant neutron excess, favoring the formation of neutron-rich compound nuclei.
The survival probability of a superheavy nucleus in heavy-ion fusion reactions is directly related to its fission barrier magnitude. In transuranium elements, the fission barrier is predominantly due to shell effects, while the liquid-drop contribution is minimal [1]. The present work aims to investigate the characteristics of the mass-total kinetic energy (M-TKE) distribution of binary reaction products from the ^{48}Ca + ^{208}Pb reaction, to conduct a detailed examination of this reaction system, and to obtain an experimental estimate of the fission barriers for ^{256}No nucleus.
The experiments were carried out using the U400 cyclotron at the Flerov Laboratory of Nuclear Reactions, Dubna, Russia. Beams of ^{48}Ca with energies of 208–281 MeV bombarded isotopically enriched thin targets of ^{208}Pb to populate the ^{256}No* compound nucleus at different excitation energies. The binary reaction products were detected in coincidence using the double-arm time-of flight (ToF-ToF) spectrometer CORSET [2]. A detailed analysis of the mass–total kinetic energy distributions of fission-like fragments from the ^{48}Ca + ^{208}Pb reaction has been performed, and fission cross sections were obtained. From a combined analysis of the fission cross section and evaporation residue cross sections for 1–3 neutron channels [3–5], the fission barrier of the ^{256}No nucleus has been estimated.

References

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Session Classification: 2. Experimental and theoretical studies of nuclear reactions

Track Classification: Section 2. Experimental and theoretical studies of nuclear reactions.