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Influence of the entrance channel asymmetry on the fission properties of excited 180Hg nuclei

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Influence of the entrance channel asymmetry on the fission properties of excited ^{180}Hg nuclei

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Fission of the pre-actinide nuclei is characterized as predominantly symmetrical even at low excitation energies. Recently, in experiments on the β^+-delayed fission of the ^{180}Tl nucleus [1], an asymmetric mass distribution of the fission fragments of its daughter nucleus ^{180}Hg with an excitation energy $E^*<10.8$ MeV was found. Note that the formation of two fragments – semimagic nuclei ^{90}Zr (N = 50, Z = 40) – should be expected in the symmetric fission of this strongly neutron-deficient nucleus. However, the formation of a light fragment with a mass of 80 u and a heavy one of 100 u was found in the fission of ^{180}Hg. Therefore, the study of the fission properties of pre-actinide nuclei is extremely important.
Thus, we propose to study reactions ^{36}Ar+^{144}Sm and ^{90}Zr+^{90}Zr, leading to the formation of the compound nucleus 180Hg in the wide range of excitation energies. In the ^{36}Ar+^{144}Sm reaction fusion-fission and fast fission are observed. Special M-TKE matrix subtraction procedure [2] allowed to separate these two processes. The reaction ^{90}Zr+^{90}Zr was measured in wide energy range. The mass asymmetry of the entrance channel in this reaction is equal to 0. At high incident energies all three possible reaction mechanisms - fusion-fission, quasifission and fast fission - contribute to the M-TKE distributions of the fissionlike reaction products. The separation of the two-dimensional M-TKE distributions of binary fragments corresponding to different reaction mechanisms allowed to obtain the main characteristics of each process. Double-arm time-of-flight spectrometer CORSET was used to measure M-TKE distributions.

1. A.N. Andreyev, J. Elseviers, M. Huyse et al., Phys. Rev. Lett. 105, 252502 (2010).
2. E.M. Kozulin et al., Phys. Lett. B 819 (2021) 136442.

The speaker is a student or young scientist

Yes

Section

1. Experimental and theoretical studies of nuclear reactions

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