PROBABILITY OF TRIPLE FISSION OF Pu^{239} *INDUCED BY 0.05—0.7 eV NEUTRONS*

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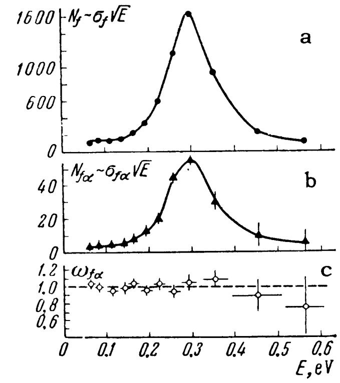
The relative cross sections for double and triple fission of Pu^{239} induced by 0.05—0.7 eV neutrons were measured with a time-of-flight instrument with a 7-μsec/m resolution. With an accuracy to 10%, the probability of triple fission of Pu^{239} is found to be independent of the neutron energy.

O measure the relative cross section for triple fission with the emission of a long-range α particle as a function of the neutron energy, we used an apparatus described earlier.[1] A double scintillation chamber was set in a neutron beam from the IBR pulsed reactor at the Joint Institute for Nuclear Research[2] with a flight base equal to 12 m. The layers with the substance undergoing fission behind an aluminum base (~ 0.5 mm), were placed at a distance of 5 cm from the α-particle detector in order to record triple fissions by means of coincidences between pulses from the fragments and from long-range α particles emitted in one hemisphere. A total quantity of ~ 250 mg of Pu^{239} was placed in the chamber. An aluminum foil (~ 7μ) shielded the α detector from scintillations which the α particles and the fragments produced in the gas scintillator of the fragment detector (f detector).

In the measurement of the relative cross sections for fission, the counting rate from the f detector was ~ 8000 ppm; the background due to natural α particles was ~ 2000 ppm; the coincidence counting rate in the energy interval 0.05—0.7 eV averaged 70 pulses/h. The total number of coincidences from possible registrations of double fission (background and random coincidences) was measured under the same conditions, but a thick aluminum screen (~ 0.5 mm) absorbing the long-range α particles was placed between the α detector and the substance undergoing fission. This number did not exceed 15% of the number of coincidences pulses applied to the 100-channel time analyzer.

The results of the measurements of the double and triple fission cross sections for Pu^{239} averaged over a broad interval of neutron energies is shown in the figure in the form $\sigma_i\sqrt{E} = f(E)$.



Change in the probability for triple fission of Pu^{239} as a function of the neutron energy: a – relative cross section for double fission (σ_f); b – relative cross section for triple fission ($\sigma_{f\alpha}$); c – probability for triple fission ($\omega_{f\alpha}$).

The data were checked with a neutron beam measured with a thin boron counter. Only the statistical errors are shown. The relative probability of triple fission $\omega_{f\alpha}$ was determined from the ratio of the relative cross section for double fission to the relative cross section for triple fission: $\omega_{f\alpha} = \sigma_f/\sigma_{f\alpha}$.

It is seen from the figure that, within the limits of the experimental error (< 10%), the value of $\omega_{f\alpha}$ remains constant in the neutron energy region 0.05—0.7 eV.

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[1] A. A. Panov, JETP **43**, 847 (1962), Soviet Phys. **16**, 599 (1963).

[2] G. V. Blokhin and D. I. Blokhintsev, Atomnaya ėnergiya (Atomic Energy) **10**, 437 (1961).

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