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Deviations from A.Bohr's formula for fission fragments angular distributions with taking into account zero wriggling-vibrations of the fissile nucleus

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The description of the fission fragments (FFs) angular distributions requires the use of quantum concepts about the dynamics of the fission process. It was demonstrated [1] that during spontaneous and low-energy induced binary fission FFs near the scission point should be in cold nonequilibrium states. For the construction of FFs angular distributions, it is necessary to take into account only zero transverse wriggling-vibrations of the fissile nucleus [2] near its scission point. The directions of FFs emission from the fissile nucleus, according to A. Bohr's hypothesis [1], are close to the symmetry axis of the fissile nucleus, which makes it possible to represent the amplitude of the FFs an-gular distribution in the form of a smeared delta function determined by the coherent superposition of large relative orbital momenta L of these fragments. The appearance of this superposition can be associated with the occurrence of zero collective transverse vibrations of pre-fragments in the vicinity of the scission point of the fissile nucleus, which leads to large values of the relative orbital momenta L of the FFs. Using the distribution of orbital momentum [3] $P(L) = 1/(\pi C_w)\exp(L^2/C_w)$, where C_w is the coefficients of wriggling -vibrations [2], the possibilities of detecting deviations of the FFs angular distributions in low-energy binary fission of aligned acti-nide nuclei by resonant neutrons and for the sub-barrier photofission of even-even actinides from the angular distributions described by the A. Bohr's formula are investigated. From the comparison of the relative measurement errors of the anisotropy coefficients in the FFs angular distributions with deviations of the theoretical values of the anisotropy coefficients calculated by taking into account the wriggling-vibrations of the fissile nucleus from their values calculated using the A.Bohr for-mula, an estimate of the wriggling vibration parameter , were carried out.

1. A.Bohr, B.Mottelson Nuclear Structure (Benjamin, New York, 1975), Vol. 2
2. J. R. Nix and W. J. Swiatecki, Nucl. Phys. A 71, 1 (1965).
3. S.G. Kadmensky, L.V. Titova, D.E. Lyubashevsky, Phys. Atom. Nucl. 83, 581 (2020)

Section

Experimental and theoretical studies of nuclear reactions

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