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Spontaneous and induced ternary fission with different third particle emission

Using the virtual approach [1,2] to describe the ternary fission as a two-stage process in which, after the light particle emission, the virtual state of the intermediate nucleus is formed, the main characteristics of the third light particle are investigated. Calculations carried out in early works within the framework of this approach [3] demonstrated good agreement with experimental data on ternary fission with the prescission α-particles emission [4].

Using experimental data for the induced by thermal neutrons [5-7] and spontaneous [8-9] ternary fission ^{235}U, ^{239}Pu and ^{252}Cf, respectively, on the basis of Gamow's alpha decay theory, formation probabilities for the prescission light nuclei ^{6}He, ^{8}He, Li, Be in the parent nuclei were obtained.

It is shown that the energy of a thermal neutron introduced into a compound fissile nucleus during induced ternary fission does not affect the energy of the prescission third particles formed during ternary fission, which fly out, like an alpha particle, from the neck of a compound fissile nucleus. This energy is stored in the energy of the collective deformation states of the compound fissile nucleus in the prescission region where the nucleus is divided into two fission fragments. It is also demonstrated that the values of energies, yields and formation probabilities calculated for prescission light particles are close in spontaneous and induced ternary fission of nuclei.

Using the results of [10], it is shown that the concept of virtuality of spontaneous and induced ternary fission with the emission of third light nuclei successfully describes the most important characteristics of this process (yields, angular and energy distributions of third particles), which allows a deeper understanding of the theory of atomic fission.

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Section

Experimental and theoretical studies of nuclear reactions

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