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Cross sections for nuclear fission by neutrons with energies up to 200 MeV: experiment and theory

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The design of nuclear installations based on accelerators (or Accelerator Driven Systems - ADS) requires sufficiently accurate data on the total and differential cross sections for nuclear fission by neutrons with energies up to several hundred MeV. The situation with the reliability and completeness of such data and other important characteristics associated with them, which cannot always be directly measured in the interaction of neutrons with nuclei, can be significantly improved by modeling such interactions. However, the current state of the theory of nuclear fission, based on the model of transition states at fission barriers, is not entirely satisfactory. A reasonable description of the dependence of the fission cross sections on the neutron energy is achieved only by using a very significant number of adjustable parameters. This is connected, in particular, with insufficient information about the spectra of transition states. Such information can be obtained if not only total but also differential fission cross sections are included in the simulation process. Indeed, according to the same model of transition states, the angular distribution of fragments is determined by how the fission probability depends on the projection K of the spin of the fissioning nucleus onto the nucleus deformation axis at the barrier. However, this dependence is determined by what values of K characterize the rotational bands of transition states at the barriers. This work briefly describes the current state of experimental studies of the total and differential cross sections for nuclear fission by neutrons with energies up to 200 MeV, as well as the progress made in calculating these characteristics.

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