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Two-center single-particle model of nuclear fission

Nuclear fission is a pronounced example of collective motion having multidimensional and nonlinear dynamics. A direct determination of dynamical coordinates has not been done due to the complexity of such a problem, which leads to the impossibility of describing a strict sequence of nucleus shapes during fission. The description of the dynamics of nuclear fission is a pending issue that requires modern computing solutions.

Nuclear models and parameterization is a specific feature of nuclear theory essential to solve the many-body problem with strong interaction. At present, there is no unambiguous approach to selecting deformation parameters, and various ways of specifying a function that describes an axially symmetric surface have been developed [1]. The deformation parameters included in the form of this function are collective dynamical variables in describing the fission dynamics.

The single-particle model as a stage in the program for describing the dynamics of nucleus fission separation serves as a basis for calculating fission barriers, level densities, and excitation schemes. The paper presents the created basis with calculations and demonstrates its features. The program allows to perform calculations for axially symmetric nuclei, whose shape can change within wide limits, up to splitting into two fragments. The shape of the nucleus is specified in the lemniscate coordinate system [2]. Unlike most methods, the proposed parameterization allows describing a wide range of nucleus shapes.

The stage of descending from the saddle point to the point where the nucleus breaks into fragments is the most fascinating in terms of nuclear dynamics [3]. The non-adiabatic effects of this stage are a promising problem, and our program will be a tool for solving it.

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Section

Nuclear structure: theory and experiment

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