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MODEL OF NUCLEON CLUSTERING AND FRAGMENT FORMATION IN HEAVY NUCLEI FISSION

The fission of heavy nuclei plays an important role as the most striking example of large-amplitude collective motion in a quantum many-body system. Reconstructing the detailed sequence of events leading to rupture remains a challenge for both experimentalists and theorists [1, 2, 3].
In this paper, we consider the problem of theoretical description of the fission fragment formation within the framework of an extended Vicsek-type collective model. The non-mean-field approach, first proposed in [4, 5], is based on microscopic modelling of the nucleon clustering as a phenomenon of collective behavior inside the many-body nuclear system. The new algorithm is aimed at modeling the occurrence of collective nucleon aggregation due to short-range mutual interaction. The developed method leverages an algorithm coming from the field of agent-based computing models.
Numerical computer simulations were carried out for the main clusters, observed experimentally in the multimodal fission of heavy and superheavy nuclei, starting with doubly magic nuclei 132Sn and 208Pb.
In superheavy nuclei, a new mode is clearly visible now - a super asymmetric mode under the influence of the 208Pb shell [6]. This mode was predicted using multidimensional potential energy surface calculations in [7].

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Section

Experimental and theoretical studies of nuclear reactions

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