DINUCLEAR SYSTEM MODEL IN SPONTANEOUS FISSION PROCESS

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The possibility of application of dinuclear system model to spontaneous fission (SF) process is discussed.

In the model the nucleus is represented as dinuclear system (DNS), which can be described with the distance R between the centers of mass of the clusters and charge asymmetry coordinate $\eta_z = (Z_h - Z_l)/(Z_h + Z_l)$, where $Z_{h,l}$ are charge numbers of heavy and light cluster, respectively.

Motion in η_z corresponds to cluster configuration formation; motion in R coordinate describes the decay process.

The determination of the DNS state for given parent nucleus can be obtained by solving the stationary Schrödinger equation with the inertia coefficient $B(\eta_z)$ [1] and potential energy $U(\eta_z)$ [2].

The potential energy and inertia parameter are approximated with step functions, therefore the Schrödinger equation can be directly solve [3].

Using this solution, the spectroscopic factors (the preformation probabilities) are calculated.

To compare the model results with experimental ones, half-lives $T_{1/2}$ are calculated in the one-dimensional WKB approximation [4].

The SF mainly occurs from the DNS configurations corresponding to the minima the driving potentials. These minima are below the potential energy of mother nucleus.

Verification of the model is made for even-even uranium isotopes $^{232–236}$U. The same set of parameters is used for all nuclei considered.

The calculated and experimental [5] half-live times are presented in table below:

	^{232}U	^{234}U	^{236}U
T_{theor}, s	7.43×10^{20}	1.61×10^{22}	1.10×10^{23}
T_{exp}, s	3.73×10^{21}	4.73×10^{23}	6.38×10^{23}

In terms of half-lives, the model presented describes well the experimental values. So, the basic assumption of the model on the collective coordinate for the SF seems to be correct.

1. G.G.Adamian *et al.* // Nucl. Phys. A. 1995. V.584. P.205.
2. G.G.Adamian *et al.* // Int. J. Mod. Phys. E. 1996. V.5. P.191.
3. J.H.Davies // Cambridge University Press, 1998.
4. B.C.Hall // Quantum theory for mathematicians. 2013. V.267. P.305.
5. J.Randrup *et al.* // Phys. Rev. C. 1976. V.13. P.229.