THE PROPERTIES OF TRUE QUATERNARY NUCLEAR FISSION WITH THE TAKING INTO ACCOUNT IT'S MULTISTEPS AND SEQUENTIAL CHARACTER

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It is demonstrated that the true ternary (quaternary) fission has two-(three-) steps character, when due to the influence of strong nonadiabatic deformation motion of the compound fissile nucleus at first the prescission light particles (neutrons, gamma-quanta, light nuclei) are emitted with forming of intermediate nuclei, which are then divided into two fission fragments. It is noted that the non-simultaneous character of the fission fragments and light particles flights is in good agreement with the condition of T-invariance of the experimentally observed T-odd asymmetries in the angular distributions of the true ternary fission products [2].

Using the results of the theory of two-proton two-steps decay of nuclei [3] it is shown that due to the large positive values of the fission energies the true ternary and quaternary fission of heavy nuclei have sequential two-steps and three-steps character when after the light particles flight the processes of the formation the lying on the mass surface of the fissioning system real states of intermediate nuclei dominate and the contribution of virtual states of these nuclei can be neglected. Using the constructed in [3] formulae for the widths of nuclear sequential basic decays the calculations of flight pobabilities angular and energy distributions for the second and first emitted prescisission third and fourth particles are carried out.

The analysis of the differences between flight probabilities, angular and energy distributions for the second and first emitted prescission third and fourth particles has been carried out using the experimental data on quaternary spontaneous and induced (by thermal neutrons) fission and it has been demonstrated that the reasons of the mentioned differences are the changes of the geometrical structure of the fissile nucleus and of the shell structure of its neck after the emission of the first prescission particle by the fissile nucleus.

It is demonstrated that the interaction between the two light particles can be significant if the particles are emitted from the fissioning nucleus in the form of long-lived quasistationary state, which then decays with the emission of mentioned particles. This fact is illustrated by the example of nuclear fission with the flight of the two α-particles with the approximately equal probabilities, as by an independent way, so as through the state of the nucleus Be-8.

1. S.G.Kadmensky, L.V.Titova // Yad. Fiz. 2013. V.76. P.16.
2. S.G.Kadmensky, V.E.Bunakov, L.V.Titova // Proc. of Conf "Nucleus-2013". St. Petersburg, 2013. P.47.
3. S.G.Kadmensky, Yu.V.Ivankov // Proc. of Conf "Nucleus-2013", St. Petersburg, 2013. P.37.