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THEORETICAL APPROACHES ALLOWING SIMULTANEOUS DESCRIPTION OF P-EVEN T-ODD ASYMMETRIES IN REACTIONS OF NUCLEAR FISSION BY POLARIZED NEUTRONS WITH THE EMISSION OF DIFFERENT LIGHT PARTICLES

Thursday, 14 July 2022 13:30 (30 minutes)

The cross section for a reaction of nuclear fission induced by polarized neutrons can be represented [1] as the sum of the cross section for the reaction with unpolarized neutrons, where is the angular distribution of such light particles p as prescission -particles and evaporative neutrons and -quanta, and the cross section , which depends linearly on the polarization vector and is expressed in terms of the sum of the components , which are even and odd with respect to the transformation . These components can be associated with quantities . The experimental values of these quantities are found [1] by the formula through the experimental values of the asymmetry coefficients (1) expressed through the experimental particle count rates p in coincidence with light fission fragments and found in [2, 3]. To find the theoretical values of the quantities, formula (2) can be used, which takes into account the rotation of the direction of emission of the particle p with respect to the direction of the emission of a light fission fragment by an angle under the action of the Coriolis interaction associated with the rotation of the fissile system (FS) around the axis, perpendicular to its axis of symmetry. Due to the parity of the angular distributions in the case of evaporation neutrons and -quanta, the value is , and the value is . In the semi-classical approach [2] the angles of rotation are calculated using the method of trajectory calculations and can only take positive values. The experimental and theoretical values of the quantities turn out to be in reasonable agreement in the case of any p particles for the 235U, 239Pu, and 241Pu nuclei. At the same time, for the 233U nucleus, it is possible to agree [2] the experimental and theoretical values of the coefficients in the case of -particles by adding to the coefficient (1) the constant associated [2] with the violation of the axial symmetry of the FS due to its transverse vibrations, while there is a complete mismatch in the signs of quantities for evaporation neutrons and -quanta. In the quantum mechanical approach [1], in contrast to the semiclassical approach, the angle of rotation can have any sign due to interference effects. Due to the complexity of calculating such angles in the quantum approach, they will be the maximum likelihood method. Then, in this approach, it is possible to agree on the experimental and theoretical values both for prescission -particles and evaporation neutrons and -quanta for all target nuclei, taking into account the fact that the angle has negative values in the case of the 233U nucleus. In the case of -particles for the 233U nucleus, the specified agreement for the value is achieved by adding a constant to (2), the appearance of which can be associated [2] with the violation of the axial symmetry of the FS, when its transverse oscillations are taken into account.

The speaker is a student or young scientist

No

Section

1. Experimental and theoretical studies of nuclear reactions

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