THEORETICAL APPROACH THAT SIMULTANEOUSLY DESCRIBES P-EVEN T-ODD ASYMMETRIES IN NUCLEAR FISSION REACTIONS BY POLARIZED NEUTRONS WITH THE EMISSION OF DIFFERENT LIGHT PARTICLES

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In [1, 2], the coefficients $D^{\exp}_{nf,p}(\theta)$ of P-even T-odd asymmetries in the cross sections of the reactions under consideration with the emission of prescission and evaporative light particles *p* were found, expressed in terms of the experimental count rates $N^{\pm}_{p}(\theta)$ of particles *p* in coincidence with light fission fragments for the directions of the polarization vector $\boldsymbol{\sigma}^{+}_{n}$ or $\boldsymbol{\sigma}^{-}_{n}$ along or against the Y axis of the l.c.s. The differential cross sections of the reactions under consideration were represented [1] by equation $d\sigma_{nf,p}(\theta)/d\Omega = d\sigma^{\{0\}}_{nf,p}(\theta)/d\Omega + d\sigma^{\{1\}}_{nf,p}(\theta)/d\Omega$ (1), where the first term $d\sigma^{\{0\}}_{nf,p}(\theta)/d\Omega = \sigma^{\{0\}}_{nf,p}P^{\{0\}}_{p}(\theta)$ corresponds to the case of unpolarized neutrons, and $P^{\{0\}}_{p}(\theta)$ is the angular distribution of light particles *p*. The second term, linearly dependent on the vector $\boldsymbol{\sigma}_n$, corresponds to the components of the analyzed asymmetries and is presented [1] in terms of the sum of ternary and quintuple correlators $\left(d\sigma^{\{1\}}_{nf,p}(\theta)/d\Omega\right)_{3(5)} = \left(d\sigma^{\{1\}}_{nf,p}(\theta)/d\Omega\right)_{ev(odd)}$ (2), where the indices ev(odd) correspond to the even (odd) components of the indicated sections with respect to transformation $\theta \to \pi - \theta$ and can be related with values $\left(\beta_{nf,p}(\theta)\right)_{3(5)} = \left(d\sigma^{\{1\}}_{nf,p}(\theta)/d\Omega\right)_{ev(odd)} \Big/ \sigma^{\{0\}}_{nf,p}$. For a theoretical description of the quantities $\left(\beta_{nf,p}(\theta)\right)_{3(5)}$, one can use [1] eq. (3) $\left(\beta_{nf,p}(\theta)\right)_{3(5)} = \Delta_{p,3(5)}\, d\left(P^{\{0\}}_{p}(\theta)\right)_{odd(ev)} \Big/ d\theta$, which takes into account the rotation at an angle $\Delta_{p,3(5)}$, between the directions of emission of a particle *p* and a light fission fragment under the action of the Coriolis interaction associated with the rotation of the fissile system around an axis perpendicular to its symmetry axis. The experimental values of the quantities $\left(\beta^{\exp}_{nf,p}(\theta)\right)_{3(5)}$ can be found as $\left(\beta^{\exp}_{nf,p}(\theta)\right)_{3(5)} = \left(D^{\exp}_{nf,p}(\theta)P^{\{0\}}_{p}(\theta)\right)_{ev(odd)}$, using the results of [1], and the results of [2, 3] in which the quantity expressed in terms of the experimental count rates $N^{\pm}_{p}(\theta)$ of particles *p* is introduced. Within the framework of the semiclassical approach, the rotation angles $\Delta_{p,3(5)}$, in (3) were calculated using the method of trajectory calculations developed in [2], which always have positive values. It is demonstrated that within the framework of the quantum approach, taking into account only the Coriolis interaction in the case of an axially symmetric fissile system, due to the complexity of the detailed calculation of the rotation angles $\Delta_{p,3(5)}$, taking into account interference effects, it is natural to use the maximum likelihood method to determine them. Due to this, it is possible to simultaneously describe the indicated asymmetries in the case of various light particles *p* for the ^{235}U, ^{239}Pu, and ^{241}Pu nuclei at positive values of $\Delta_{p,3(5)}$, as well as for quintuple correlators in the case of α-particles, evaporation neutrons, and γ-quanta for the ^{233}U nucleus at negative values of $\Delta_{n'(\gamma),\alpha,5}$. Adding a constant to the triple correlator related [1] to axial symmetry breaking leads to agreement in the case of α-particles for the ^{233}U nucleus. Therefore, within the framework of the quantum approach, taking into account the conditions presented above, it is possible to simultaneously describe P-even T-odd asymmetries in the cross section of the reactions under consideration with the emission of various light particles *p* for the case of all target nuclei ^{233}U, ^{235}U, ^{239}Pu and ^{241}Pu.

1. *Kadmensky S.G., Bunakov V.E., et al.* // Bull. Russ. Acad. Sci.: Phys. 2019. V. **83**. P. 1128.
2. *Gagarski A., Goennenwein F., Guseva I., et al.* // Phys. Rev C. 2016. V.**93**. P. 054619.
3. *Danilyan G.V., Klenke J., Kopach Y.N., et al.* // Nucl. Phys. 2014. V. **77.** P. 677.