MATHEMATICAL MODELLING OF NEUTRON TRANSFERS AT NUCLEAR REACTIONS WITH ACCOUNTING OF SPIN-ORBIT INTERACTION

Samarin K.V.

Chuvash State University, Physical and mathematical faculty, Dep. of theoretical and experimental physics, Russia, 428024,. Cheboksary, Mira pr., 29, 123, ph. (8352) 63-98-55, E-mail: animator@cheb.ru

The difference schema for numerical solution of a time-depended system of two Schrödinger equationses with the operator of a spin-orbit interaction for a two-component spinor wave function

$$i\hbar\frac{\partial}{\partial t}\begin{pmatrix}\psi_1\\ \psi_2\end{pmatrix}=\left\{-\frac{\hbar^2}{2m}\Delta+V(\vec{r})-b_1\vec{\sigma}\left[(\nabla V)\vec{p}\right]\right\}\begin{pmatrix}\psi_1\\ \psi_2\end{pmatrix}. \qquad (1)$$

is offered on the basis of a split method for a time-depended Schrödinger equations [1]. The computer simulation of wave function changes of an external neutron with a minimum projection of the full moment to an internuclear axis and probabilities of its transfer is executed at head-on collisions of ^{40}Ca and ^{96}Zr nuclei. The areas of large values of a full probability density for three times are showed in a fig. 1. Thus, the results of [2] about primary transfer up to barrier distances of neutrons with a minimum module of a projection of the moment on an internuclear axis are verified.

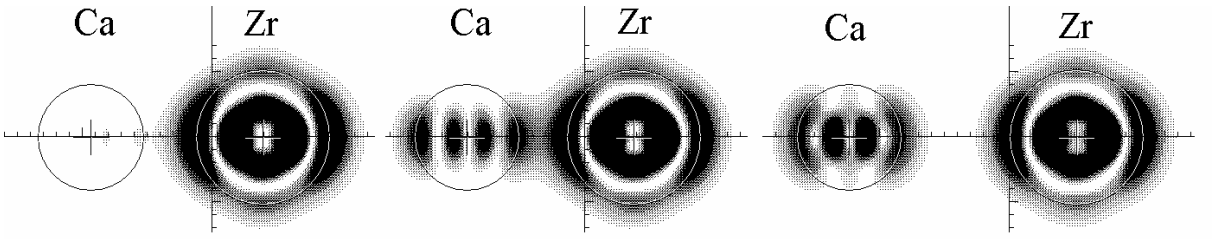

Fig. 1. The probability density for external neutrons of ^{96}Zr with a moment projection to an internuclear axis $\Omega=1/2$ at collision with ^{40}Ca. The course of time corresponds to direction from left to right.

References

1. *Riley M.E., Ritchie B.* Numerical time-dependent Shrödinger description of charge-exchange collisions. // Phys. Rev. A, v. 59, 1999, P. 3544-3547.
2. *Greiner W. et al.* Sub-barrier fusion of neutron-rich nuclei and its astrophysical consequences// Phys. Rev. C, 2007. V. 75, 035809. P. 1-11