Angular Correlation Analysis in the Neutrons Capture Process by ^{109}Ag Nucleus

V.L. Kuznetsov[1,2], L.V. Mitsyna[1], A.I. Oprea[1,3], C. Oprea[1,4], N.V. Rebrova[1], P.V. Sedyshev[1]

[1]*Frank Laboratory of Neutron Physics, Joint Institute for Nuclear Research, IIO, Dubna*
[2]*Institute for Nuclear Research of the Russian Academy of Sciences, Moscow, Russian Federation*
[3]*Technical College "Alexandru Roman", Alesd, Bihor County, Romania*
[4]*National College "Emanuil Gojdu" Oradea, Bihor County, Romania*

Angular distributions in the ^{109}Ag(n,γ)^{110}Ag reaction were evaluated in the framework of Flambaum-Sushkov's approach and the two-levels approximation. The angular correlation is a pondered sum of Legendre polynomial with coefficients that depend on the energy of the incident neutrons, the partial reduced widths of the incident neutrons, and the emergent gamma. These coefficients are of interest in the evaluation of asymmetry and parity-breaking effects in neutrons induced processes.

Several computer simulations have been done to evaluate the impact of experimental conditions on the angular distribution coefficients and asymmetry effects. The computer evaluation took into consideration the target's dimensions, the attenuation of neutrons and gamma rays, the flux of incident neutrons, and other parameters. Additionally, the analytical expression of the polar angle was obtained by the Direct Monte-Carlo method. Computer analyses have shown that more than 10% of the gamma quanta are lost in the target of a thickness of 1 mm and a transverse area of 1 cm^2. In the case of a 10% forward-backward asymmetry coefficient, edge effects can be neglected. For asymmetry and parity breaking effects, gamma attenuation, edge effects and target dimensions become significant at values below 0.1.

For neutrons' energy near 30 eV in the ^{109}Ag(n,γ)^{110}Ag process, where the forward-backward effect is approximately 0.2, the coefficient corresponding to the second-order Legendre polynomial is approximately 0.05. Absolute errors of the forward-backward effect and second order Polynomial Legendre coefficient were also derived under various experiment settings and cross-section experimental precisions.

The results of the simulations are helpful for future measurements of the angular distribution and related asymmetry and parity violation effects, which will be carried out at the neutrons source IREN, the FLNP JINR basic facility.

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