

NEUTRON ANGULAR DISTRIBUTION IN POLARIZED MUON CAPTURE
BY ^{40}Ca NUCLEUS

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The angular distribution of neutrons emitted by nucleus in polarized muon capture by ^{40}Ca nucleus from K-shell mesoatom has the form:

$$\frac{d\sigma}{d\Omega} = N(E)\{1 + \alpha(E)P_{\mu}\cos\theta\},$$

where P_{μ} is the muon polarization, θ is the angle between the emitted neutron momentum and the direction of muon polarization, $4\pi N(E)$ is the total cross section of emitted neutron at energy E and $\alpha(E)$ is the asymmetry coefficient which expresses the degree of space parity violation in weak capture process.

The recent measurement of asymmetry coefficient at the neutron energies higher than 15 MeV⁽¹⁾ gives rather high values amounting to about 0.3 - 0.4, which is opposite in sign from the results of the previous measurements⁽²⁾. However, smaller values for the asymmetry coefficient, $|\alpha(E)| < 0.1$, are obtained by theoretical calculations⁽³⁾. In the recent work⁽⁴⁾ the asymmetry coefficient is evaluated using various values of parameters in describing the interaction of emitted neutron with residual nucleus, and in some cases the obtained values are closer to the experimental ones.

In this work the influence of various relativistic corrections to the values of matrix elements has been studied, and $\alpha(E)$ estimated.

The contribution from small component of muon wave function amounts to about 7%, and consequently cannot be neglected, whereas the radiative corrections are negligible (<1%). The space distribution of charge affects considerably muonic wave function, changing magnitudes of matrix elements up to 20%. The asymmetry coefficient is sensitive to the final state wave function description, namely, the LS-interaction in optical potential must be taken into account in determination of neutron wave function.

References

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2. See references in Ref. 1.
3. V.V. Balashov and R.A. Eramzhyan, Atomic Energy Review (IAEA, Vienna) 5 (1967) 3.
4. K. Kume, N. Ohtsuka, H. Ohtsubo and M. Morita, Nucl. Phys. A251 (1975) 465.