ANGULAR CORRELATIONS IN THE 14.1 MeV NEUTRONS INELASTIC SCATTERING ON Al

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The angular distributions of the γ-quanta from ^{27}Al(n, n′γ) reaction were measured using the tagged neutrons method and the TANGRA setup of JINR FLNP [1, 2]. The neutron generator ING-27 was used as a 14.1 MeV neutron source. The γ-quanta, emitted in the neutron inelastic scattering (INS), were registered by a system of 22 NaI(Tl) scintillator detectors, placed around the sample with 15° step. For protection of the γ-detectors from ING-27 neutrons, a compact iron shielding was used. The background radiation induced events were drastically reduced by "tagging" the neutrons and using the Time-of-Flight (ToF) method. This technique was successfully tested on ^{12}C [3].

For quantitative description of the γ-quanta emission angular distribution, an anisotropy parameter $W(\theta)$ is introduced and defined as a "normalized" differential cross-section: $W(\theta) = 1 + \sum_{i=2}^{2J} a_i P_i(\cos\theta)$ where J is a gamma-transition multipolarity, $P_i(\cos\theta)$ are Legendre polynomials.

There is some information on ^{27}Al(n, n′γ) reaction with ~14 MeV neutrons [4], but there are not angular distribution data published even in some databases [5]. We observed five γ-transitions in ^{27}Al and determined their $W(\theta)$ (see Tab. 1). In this experiment the anisotropy parameters obtained were found to be quite similar for all observed transitions.

Table 1. Legendre coefficients for angular distributions of γ-transitions in ^{27}Al*.

E_γ, MeV (multipolarity)	1.01 ($M1$+$E2$)	1.72 ($M1$+$E2$)	2.21 ($M1$+$E2$)	3.00 ($E2$)
a_2	0.22 ± 0.02	0.30 ± 0.01	0.30 ± 0.03	0.35 ± 0.03
a_4				0.06 ± 0.04

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