The 300 and 330 keV Transitions in ^{227}Ac

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The mixing ratios, $\delta^2 = T(E2)/T(M1)$, for the $3/2^-1/2^-(530)$ - $5/2^-3/2^-(532)$ and $3/2^-1/2^-(530)$ - $3/2^-3/2^-(532)$ transitions of 300 and 330 keV in ^{227}Ac can not be deduced on the basis of existing conversion[1] and gamma-ray data. We therefore measured angular distributions of the corresponding gamma rays from an oriented source (^{231}Pa implanted in a Gd host and kept in a strong magnetic field at ~20 mK). Since both the radiations depopulate the same state their orientation and deorientation coefficients cancel out in the ratio of theoretical distribution coefficients, which is measured to be:

$$A \equiv A_2(300)/A_2(330) = 0.11 \pm 0.14 \ .$$

With our relative gamma intensities, and K conversion intensities from ref.1, the ratio of K-conversion coefficients for those transitions is:

$$\alpha \equiv \alpha_K(300)/\alpha_K(330) = 1.42 \pm 0.06.$$

Neglecting the possible E0 contribution to the 330 keV transition and using the theoretical functions $A = f(\delta_{300}, \delta_{330})$ and $\alpha = g(\delta_{300}, \delta_{330})$, these results were analysed in the δ_{300}- δ_{330} plane (Fig.1). Values that satisfy both equations are:

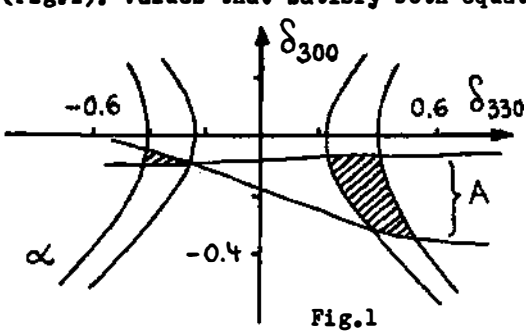

Fig.1

$$\delta^{exp}_{300} = -0.20 \pm 0.15$$

$$|\delta^{exp}_{330}| = 0.40 \pm 0.15 \ .$$

Pure Nilssonian values, for $\beta \simeq 0.3$, are [2,3]:

$$\delta^{th}_{300} = -0.09$$

$$\delta^{th}_{330} = +0.16$$

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1) S.Baranov et al, JETP 14(1962)1053

2) D.Krpić et al, ADNDT 18(1976)509

3) E.Browne, F.Femenia, NDT 10(1971)81