III. 13 g-FACTORS OF THE 264 keV AND 632 keV STATES IN ^{77}As

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The integral perturbed angular correlation technique has been used to measure the g-factors of the 264 keV and 632 keV states in ^{77}As. The measurement of the 264 keV level was performed in an external magnetic field of 30 kOe. The 632 keV state, having a shorter lifetime, was studied with the help of the large hyperfine magnetic field present at As nuclei in an Fe matrix.

The decay scheme of ^{77}As, showing the relevant levels and transitions is presented in fig. 1. A conventional automated coincidence spectrometer with two NaI(Tl) detectors and a standard water cooled magnet have been used. The g-factor of the 264 keV ($5/2^-$) state was determined through the 367-264 keV gamma cascade. The radioactive ^{77}Ge sources were produced by neutron irradiating 10 mg of GeO_2 enriched to 74% in ^{76}Ge. Previous measurement of angular correlations with a liquid source[1)] have shown that attenuations due to extranuclear interactions are negligible for the solid GeO_2 source.

Experimental values of $\omega\tau$, the spin precession angle in the magnetic field, were obtained from the ratio

$$R(\theta) = \frac{W(\theta,+H) - W(\theta,-H)}{W(\theta,+H) + W(\theta,-H)} = \frac{2b_2\omega\tau}{1+(2\omega\tau)^2}$$

measured at angles of 135^o and 225^o for three sources ($b_4 << b_2$). Values of $\omega\tau(225^o)$ = $(-2.36\pm0.60)x10^{-2}$ rad, $\omega\tau(135^o) = (+2.45\pm0.54)x10^{-2}$ rad and $\omega\tau(225^o) = (-1.93\pm0.51)x10^{-2}$ rad respectively were obtained and $\omega\tau = (2.25\pm0.32)x10^{-2}$ rad was deduced from the weighted average of the measurements. The lifetime of the 264 keV level in ^{77}As has been recently reported by Chopra et al[2)] to be $\tau = 500 \pm 30$ ps. Using a fast coincidence system with Pb loaded plastic scintillators we also measured the lifetime of this state. Our result (to be published elsewhere) is $\tau = 400 \pm 30$ ps.

The average value of $\omega\tau = (2.25\pm0.32)x10^{-2}$ rad with H = 30 kOe and $\tau = 450\pm30$ ps yields the g-factor of the 264 keV state: $g_{5/2^-} = +0.33\pm0.05$.

The g-factor of the short-lived 632 keV level was measured making use of the hyperfine field present at As nuclei in a dilute solid solution (1 at %) of Ge as impurity in Fe. The ^{77}Ge activity in metallic form was deposited in a pot made of pure Fe. A tapered pin was driven in the pot under vacuum and the sealed pot was melted in an induction coil in presence of Argon gas. After melting, the alloy was annealed for 2 h at 800^oC in Ar atmosphere and placed in a polarizing field of 5 kOe. The ratio $R(\theta)$ was then measured at $\theta = 135^o$ and 225^oC for both states, 264 keV and 632 keV, in the same source through the 367-264 and 558-417 keV gamma sequences respectively.

The results are shown in table 1, giving average values of $\omega\tau$(264 keV) = 0.204±0.014 rad and $\omega\tau$(632 keV) = 0.185±0.030 rad, under the same hyperfine magnetic field. Using the known lifetimes (table 1) and the measured g-factor of the 264 keV state in an external field, the g-factor of the 632 keV state is obtained to be $g_{5/2+} = +1.42\pm0.32$.

Recently Chopra and Tandon[5,6] measured the g-factor of both levels, 264 keV and 632 keV, using the hyperfine field on As in a GeFe alloy. In the analysis of their data Chopra and Tandon used the hyperfine field obtained from a NMR experiment by Koi et al[7] in a AsFe alloy. Our value for the g-factor of the 264 keV is in good agreement with their result of $g_{5/2^-} = +0.30\pm0.03$ (with τ = 500 ps), but they obtain a lower value of $g_{5/2^+} = +0.79\pm0.17$

Table 1-Values of $\omega\tau$ for the ^{77}As states of 264 keV and 632 keV in a GeFe alloy

	264 keV	632 keV
$\omega\tau(225^o)$	-0.196 ± 0.018 rad	-0.190 ± 0.045 rad
$\omega\tau(135^o)$	$+0.212\pm0.020$ "	$+0.181\pm0.040$ "
$\overline{\omega\tau}$ a)	0.204 ± 0.014 "	0.185 ± 0.030 "
τ(ps)	450 ± 30	95 ± 8 c)
g	$+0.33\pm0.05$ b)	$+1.42\pm0.32$

a) Average value of $\omega\tau$ at θ = 135^o and 225^o.

b) Measured with an external field of 30 kOe.

c) Weighted average from refs. 3 and 4.

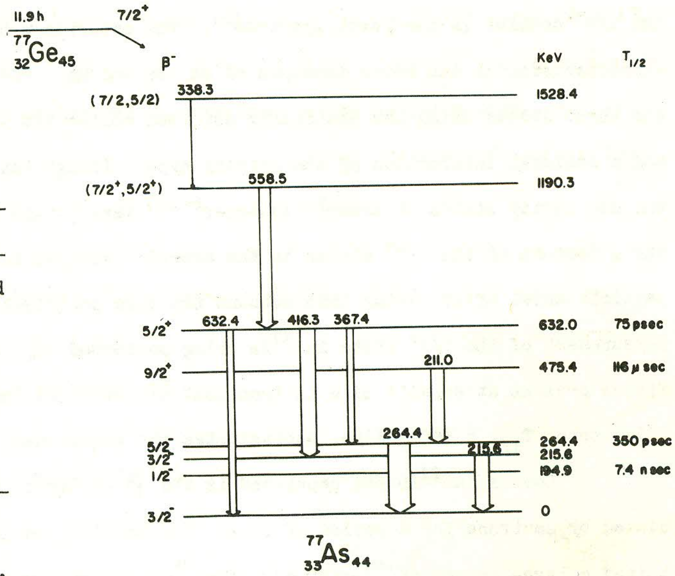

Figure 1-Partial decay scheme of ^{77}Ge to levels in ^{77}As

for the 632 keV state. Our result of $\mu = +3.55\pm0.90$ n.m. agrees reasonably with the calculated value of 4.3 n.m. for a $5/2^+$ state obtained by coupling of the $g_{9/2}$ proton with the first 2+ state of the neighbouring nuclei.

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