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V–10 The Magnetic Moments of the $K^\pi = 2^-$ Band in ^{182}W

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The structure and the properties of a rotational band in ^{182}W built on the 1289 keV state have been studied through the measurements of γ-γ angular correlations in external magnetic fields. A partial decay scheme of ^{182}W is shown in Fig. 1. Natural tantalum in powder and in an alloy of Ta-Fe containing 0.5 at .% Ta both irradiated in the Kyoto University Reactor, were used as sources for the g-factor measurements of the 2^- and 3^- states, respectively. The result of the angular correlation measurements for the 179–152 and 264–1189 keV cascades taken with the use of an NaI-Ge goniometer system[1] are

$$A_2 = -0.165 \pm 0.012, \quad A_4 = 0.018 \pm 0.022$$

and

$$A_2 = 0.148 \pm 0.010, \quad A_4 = 0.012 \pm 0.016,$$

respectively. From the measurements in an externally applied magnetic field of 15.9 kOe the following precession angles were obtained;

$$\omega_2\tau_2 = 0.098 \pm 0.013 \quad \text{for the } 2^- \text{ state and}$$
$$\omega_3\tau_3 = 0.207 \pm 0.026 \quad \text{for the } 3^- \text{ state.}$$

Using the half-life 1.12 ± 0.02 ns for the 2^- state,[2] the g-factor of this state was obtained as $g_2 = 0.85 \pm 0.11$. As for the 3^- state no reliable lifetime has been reported. We got $g_3\tau_3 = (0.072 \pm 0.009) \cdot 10^{-9}$ sec using the internal magnetic field of 598 ± 13 kOe.[3] If the 85 keV transition is a pure rotational one, τ_3 is given as $\tau_3^{-1} = (4/3)E^3c^{-3}\hbar^{-4}\mu_N^2 \times(g_K-g_R)^2K^2(I-K)(I+K)I^{-1}(2I+1)^{-1}R_{M1}$, where R_{M1} represents the ratio of the total de-excitation rate of the 1374 keV state to the M1 transition rate of the 85 keV γ-ray and has a value of 13.0 ± 1.1 for the present case. Since the g-factor of the rotational state is given as $g(I, K) = g_R + (g_K - g_R)K^2I^{-1}(I+1)^{-1}$, the relation $(g_K - g_R)^2 = (0.146 \pm 0.22)(2g_R + g_K)$ is obtained for the 3^- state. For the 2^- state $2g_K + g_R = 2.55 \pm 0.33$ has been derived from the value g_2 described above. These two relations give two pairs of solutions for g_K and g_R: $g_K = 1.03 \pm 0.12$, $g_R = 0.49 \pm 0.09$ and $g_K = 0.62 \pm 0.06$, $g_R = 1.31 \pm 0.19$. The former pair is reasonable with respect to the value of g_R.

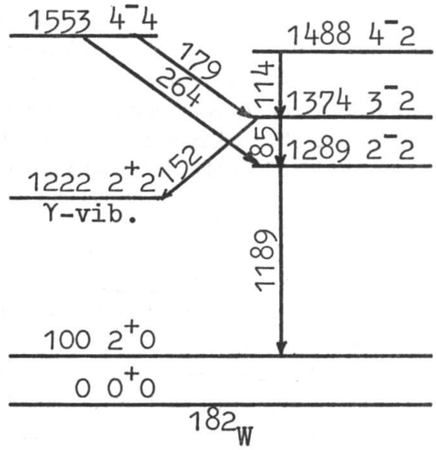

Fig. 1.

The g-factor of the 2^- state reported by Bhattacherjee *et al.*[4] is $g_2 = 0.52 \pm 0.12$. This is much smaller than the present value. The two-quasiproton configuration of $\{514\uparrow\text{–}402\uparrow\}$ gives $g_K = 0.91$ and 0.96 for $g_s = 5.58$ and 2.62, respectively, showing good agreement with our value. This indicates that the configuration given by Solovev[6] is better than the one by Neergaard and Vogel[6] for the 2^- state. The g_R value of the 2^- band is larger than the value $g_R = 0.30$ for the first 2^+ state, but this difference can be explained with the increase of the moment of inertia of the proton part $\mathcal{I}_p$ caused by the rupture of one proton pair corresponding to the difference of the energy spacings of the two bands.

References

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