sample, T_{C} is the transmission of carbon in the sample, and T_{C} is also transmission of carbon blank.

$$N_0=(T_c)\left(\frac{Al_s}{\ln T_{\mathrm{H}}}\right)\underbrace{\int\cdots\int}_{\text{fourfold}}\frac{d\tau_2dt}{r_2^2}\left(\frac{E_0}{E}\right)^{1/2}$$

$$\times\left(\frac{1}{1+C(t/E_0+\alpha\theta_2^2)^2}\right),\quad\text{(II2)}$$

where l_s is the length of the scatterer. The quantity $(E_0/E)^{1/2}$ varies between 1.005 and 0.995 over the range of integration. The fourfold integral can be performed analytically by setting this factor equal to 1, and setting $\sin\theta_2$ equal to θ_2. A change of variable to $t'=2(t/\Gamma)$ is convenient, and negative values of t are used for energies over E_0. The function obtained is

$$J=2\pi(l_d)\frac{\Gamma}{4\alpha C}\Big[(t'+\theta_m{}^2\alpha\surd C)\tan^{-1}(t'+\theta_m{}^2\alpha\surd C)$$

$$-t'\tan^{-1}t'-\tfrac{1}{2}\ln[1+(t'+\theta_m{}^2\alpha\surd C)^2]$$

$$+\tfrac{1}{2}\ln(1+t'^2)\Big]_{t'_{\mathrm{min}}}^{t'_{\mathrm{max}}},\quad\text{(II3)}$$

where l_d is the length of the detector. This function is also of general interest as it gives the combined effect of target thickness and detector geometry on the shape of resonance curves obtained when the incident particle energy varies with angle.

Substituting the value of N in Eq. (II1) gives

$$d\sigma_{\mathrm{H}}/\sigma_{\mathrm{H}}=I/\pi l_sJ.\quad\text{(II4)}$$

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Gyromagnetic Ratio of the 2^+ State of Os^{188} *

G. Goldring, Drora Kedem, and Z. Vager
Department of Nuclear Physics, The Weizmann Institute of Science, Rehovoth, Israel

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The gyromagnetic ratio of the 2^+ state of Os^{188} of 155 keV excitation was measured by observing the precession in an external magnetic field of the angular distribution of the de-excitation gamma rays following Coulomb excitation with an atomic hydrogen beam. The mean life of the 2^+ state of Os^{188} was also measured by comparing the yield of gamma rays from this level to the yield of gamma rays from the 2^+ state in W^{184}. The mean life of the Os^{188} level was determined to be $\tau=1.05\pm0.10$ nsec, in good agreement with recent direct measurements, and the gyromagnetic ratio was found to be $g=0.20\pm0.02$.

INTRODUCTION

In a previous communication from this laboratory[1] a measurement of the gyromagnetic ratios of the 2^+ states of the even tungsten isotopes was reported. In that measurement a neutral atomic beam of hydrogen atoms of 1.4 MeV was employed to excite the 2^+ levels, and the angular distribution of the de-excitation gamma rays as well as the angular shift of the distribution pattern in an external magnetic field were observed. A similar measurement was now carried out for the 2^+ state of Os^{188}. Such a measurement, in particular, in conjunction with the tungsten measurements is of interest because Os^{188} is just beyond the region of nuclei of distinctly rotational structure. Another point of a more technical character is that because of the short life-time of the Os^{188} level and the relatively low value of its estimated quadrupole moment, the angular distribution of the gamma rays—at least from a metallic target—may be expected to be very nearly unperturbed.

ANGULAR DISTRIBUTION AND PRECESSION MEASUREMENTS

A metallic target of Os^{188} was prepared in a manner similar to that described in reference 1 for the tungsten targets. The angular distribution and the precession measurements were carried out with protons and hydrogen atoms of 1.45 MeV. The coefficients A_2, A_4 were evaluated for the unperturbed distribution

$$W(\theta)=1+G_2A_2P_2(\cos\theta)+G_4A_4P_4(\cos\theta).$$

The attenuation coefficients are seen to be essentially equal to unity and the distribution can, therefore, be considered unperturbed.

The precession angle in a field of 19.8±0.2 kG was measured in the manner described in reference 1 and was found to be $\omega\tau=0.020\pm0.001$ rad.

As a general check of the method an anisotropic source was simulated by encasing a Co^{57} source in a cylindrical tin absorber, the thickness of which varied with the distance from the source, so as to produce a radiation intensity outside the absorber approximating the angular distribution of the gamma rays from the

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[1] G. Goldring and Z. Vager, Phys. Rev. **127**, 929 (1962).

TABLE I. Summary of measurements for the 155-keV 2^+ state in Os^{188}. A_2, A_4 are the coefficients of the Legendre polynomials P_2, P_4 appropriate to an unperturbed distribution. G_2, G_4 are the measured attenuation coefficients. $\epsilon(\gamma)$ is the change in γ counts in each counter with field (19.8 kG) and without field. The ϵ values are related to the double ratio measurements by: $R=[(1+\epsilon)/(1-\epsilon)]^2$.

A_2	A_4	G_2	G_4	$100\epsilon(\gamma)$	τ (nsec)	g This work	g Previous work	Z/A
0.3114	-0.079	1.025 ± 0.030	0.94 ± 0.12	0.663 ± 0.035	1.05 ± 0.07	0.20 ± 0.02	0.29 ± 0.03[a]	0.404

[a] See reference 7.

tungsten and osmium 2^+ levels. This source was placed in the target position in the magnetic field and shifted a few degrees to the left and to the right to simulate the rotation of the distribution due to precession. The double ratio of counts in the two counters in the two source orientations was found to agree with the value corresponding to the measured angular distribution. This proves among other things that the angular distribution of gamma rays issuing from the target position is not distorted by unsuspected scattering effects.

MEASUREMENT OF THE MEAN LIFE

The mean life of the Os^{188} level was determined by comparing the thick target yield of gamma rays from the Os^{188} target and from a W^{184} target bombarded by protons of 2.0 MeV. Assuming the energy loss of protons per mg cm^{-2} in the two targets to be the same, the ratio of yields is given by[2]

$$\frac{Y(\mathrm{Os}^{188})}{Y(\mathrm{W}^{184})}=F\frac{\tau(\mathrm{W}^{184})}{\tau(\mathrm{Os}^{188})}\frac{1+\alpha(\mathrm{W}^{184})}{1+\alpha(\mathrm{Os}^{188})},$$

where the τ's are the mean lives of the two states and the α's are the total conversion coefficients for the two transitions. F is a known function of the Z and A values for the two nuclei and of the respective excitation energies and is equal in our case to $F=1.87$. The conversion coefficients were evaluated from the tables of Rose.[3] The ratio of the yields was measured as

$$Y(\mathrm{Os}^{188})/Y(\mathrm{W}^{184})=0.70\pm0.04,$$

and for the ratio of the mean lives we get

$$\tau(\mathrm{Os}^{188})/\tau(\mathrm{W}^{184})=0.59\pm0.04.$$

The mean life of the W^{184} level has been measured directly[4] as $\tau(\mathrm{W}^{184})=1.79\pm0.09$ nsec and this value has been found to be in excellent agreement with the value derived from inelastic scattering cross section measurements,[5] verifying among other things the calculated value of the conversion coefficient. We thus get for the mean life of the Os^{188} level:

$$\tau(\mathrm{Os}^{188})=1.05\pm0.10 \text{ nsec}.$$

In a recent direct measurement[6] of the mean life of this state a value of $\tau=1.05\pm0.09$ nsec was found in excellent agreement with our measurement. We adopt the value:

$$\tau=1.05\pm0.07 \text{ nsec}.$$

RESULTS

The results of these measurements are summarized in Table I. The value of the g factor, $g=0.20\pm0.02$, is compared with the value found in a previous measurement,[7] which we have corrected for the new and more accurate value of the mean life. We note that in Os^{188} as in the purely rotational tungsten isotopes we find a value for the g factor which is appreciably smaller than Z/A.

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