$A=1/\tau^- - 1/\tau^-_{\text{decay}}$, assuming that τ^-_{decay} is, in fact, equal to 2.22 ± 0.02 μsec. They do not depart significantly from the values obtained by extrapolating with a Z^4 dependence the results of previous measurements[3,4] for $Z>7$. Our experimental value of A for carbon may be compared with the values calculated by Preston and Duret[5] assuming a charge-exchange reaction with a coupling constant equal to that determined from the neutron β-decay. The comparison indicates that the coupling constants for μ-capture and β-decay are equal to within about 30 percent, strengthening the argument for a universal interaction between pairs of fermions.

* Now with Newmont Exploration Ltd., Jerome, Arizona.
1 W. E. Bell and E. P. Hincks, Phys. Rev. **84**, 1243 (1951).
2 J. A. Wheeler, Revs. Modern Phys. **21**, 133 (1949).
3 H. K. Ticho, Phys. Rev. **74**, 1337 (1948).
4 An account of existing data, with references, may be found in B. Rossi, *High Energy Particles* (Prentice-Hall, Inc., New York, 1952), Sec. 4.9.
5 M. A. Preston and M. F. Duret, following Letter [Phys. Rev. **88**, 1425 (1952)].

The Coupling Constant of the Nucleon-μ-Meson Interaction

M. A. PRESTON AND M. F. DURET*
Physics Department, University of Toronto, Toronto, Ontario, Canada
(Received October 31, 1952)

ON the hypothesis of a "universal" interaction for particles of spin $\frac{1}{2}\hbar$, μ-capture ($P+\mu^-\rightarrow N+\nu$) and β-decay will be described by interaction Hamiltonians containing the same five coupling constants g_K, $K=S, V, T, A, P$. We write $g_S^2+g_V^2=(1-x)g^2$, $g_T^2+g_A^2=xg^2$, $G^2=(1+2x)g^2$. Recent β-decay evidence[1] suggests $\frac{1}{2}\lesssim x\lesssim\frac{4}{5}$. The decay of the neutron gives $G_\beta=(3.12\pm0.4)\times10^{-49}$ erg cm³. From μ-capture data, Tiomno and Wheeler[2] have estimated $G_\mu\sim10^{-49}$ erg cm³.

More recently, Kennedy has used a shell model to study the experimental results with heavy elements[3] and finds $G_\mu\sim3\times10^{-49}$ erg cm³. We have attempted to obtain a more reliable value of G_μ based on the μ-capture rate in C^{12}, since this has been measured and considerable information about the momentum distribution in this nucleus is now available.

We have expressed A, the transition probability for μ-meson capture, in terms of the nucleon momentum distribution. With a "gas" model approximation, we have

$$A=M\hbar^{-4}G_\mu^2\Psi^2\int_0^{q_0}dq\,q\int_0^\infty\rho W(\mathbf{p}_P)[1-W(\mathbf{p}_N)]y\,dy.$$

Here $\mathbf{p}_P$, $\mathbf{p}_N$, and $\mathbf{q}$ are proton, neutron and neutrino momenta, $cq_0=\mu c^2-\Delta$, $y=|\mathbf{p}_P\times\mathbf{q}/q|$, and $\mu c^2=cq+\Delta+(p_N^2-p_P^2)/2M$, where Δ= mass of B^{12} atom − mass of C^{12} atom + meson binding energy $+mc^2$. The momentum distribution is $\rho W(\mathbf{p})$, where ρ is a density of order (nuclear dimensions/$\hbar$)³ determined explicitly by the normalization of the momentum distribution and $W(\mathbf{p})$ is the probability that a nucleon with momentum $\mathbf{p}$ is in one of the states which is occupied in the initial nucleus. The average over the nucleus of the K-shell meson probability density is Ψ^2.

High energy (n, d),[4] (p, p),[5] and (p, π)[6] experiments on C^{12} agree with a momentum distribution represented by (a) a Gaussian of average energy 14–19 Mev or (b) the Chew-Goldberger $(\alpha^2+p^2)^{-2}$ distribution cutoff at 72 Mev. Taking $G_\mu=3.12\times10^{-49}$ erg cm³, we find for A the values in the second column of Table I.

TABLE I. Calculated transition probabilities and the values of G_μ.

Model	A (10^4 sec⁻¹) with $G_\mu=3.12\times10^{-49}$	G_μ(10^{-49} erg cm³)
Gaussian: $\bar{E}=18$ Mev	8.65	2.5 ± 0.3
Chew-Goldberger-Temmer	8.86	2.5 ± 0.3
Shell: $x=0.8$	4.67	3.4 ± 0.4
Shell: $x=0.5$	4.48	3.5 ± 0.4
Shell: $x=0.8$	2.11*	5.0 ± 0.7*
Shell: $x=0.5$	1.92*	5.3 ± 0.8*

We have also made calculations using the shell model. Here we would expect the results to be reliable for transitions to low-lying bound states only. We use spherical potential wells to represent the nuclei. Their depths are found from the known separation energies of the $1p$ protons of C^{12} and $1p$ neutrons of B^{12}. On this model there are then no higher bound single particle states in B^{12}, and the matrix elements required are those from the various $s_{\frac{1}{2}}$ and $p_{\frac{3}{2}}$ states of C^{12} to the $p_{\frac{1}{2}}$ states of B^{12}. Using the above value for G_μ, we obtain for the transition probability to the bound states:

$$(1+2x)^{-1}[3.62(1-x)+4.76(3x)]\times10^4\ \text{sec}^{-1}.$$

Some of these states, which are bound on the shell model, have excitations of ∼11 Mev. Since the shell model is not reliable in these cases, we have also shown the transition probabilities excluding these states. (These values are labelled with an asterisk in Table I.)

Comparing the calculated values in the second column of Table I with the value $A=5.5\pm1.5\times10^4$ sec⁻¹ determined by Bell and Hincks,[7] we find the values of G_μ given in column three. We may safely conclude that G_μ lies in the range (2.5 to 5.0) $\times10^{-49}$ erg cm³, and for reasons discussed in a fuller account (to be submitted to the Canadian Journal of Physics), we feel that the most likely value of G_μ is about 3.2×10^{-49} erg cm³.

* Holder of a National Research Council of Canada Studentship.
1 O. Kofoed-Hanson and A. Winther, Phys. Rev. **86**, 428 (1952); R. Nataf and R. Bouchez, Phys. Rev. **87**, 155 (1952); J. M. Blatt, unpublished.
2 J. Tiomno and J. A. Wheeler, Revs. Modern Phys. **21**, 153 (1949).
3 Keuffel, Harrison, Godfrey, and Reynolds, Phys. Rev. **87**, 942 (1952); J. M. Kennedy, Phys. Rev. **87**, 953 (1952).
4 G. F. Chew and M. L. Goldberger, Phys. Rev. **77**, 470 (1950).
5 G. M. Temmer, Phys. Rev. **83**, 1067 (1951); Cladis, Hess, and Moyer, Phys. Rev. **87**, 425 (1952); P. A. Wolff, Phys. Rev. **87**, 434 (1952).
6 E. M. Henley and R. H. Huddlestone, Phys. Rev. **82**, 754 (1951).
7 W. E. Bell and E. P. Hincks, preceding Letter [Phys. Rev. **88**, 1424 (1952)].

The *g* Factor of Ferrites

TOSIHIKO OKAMURA, YOSIHARU TORIZUKA, AND YUZO KOJIMA
Research Institute for Scientific Measurements, Tohoku University, Sendai, Japan
(Received October 16, 1952)

THE microwave resonance in Ni ferrite and Mn ferrite was observed in polycrystalline specimens at several frequencies from 9450 Mc/sec to 47,000 Mc/sec, and it was found that the frequency dependence of the apparent g factors could be explained in relation to the anisotropic internal field in the material.

Many spherical specimens whose diameter varied from about 3 mm to 0.3 mm were polished from a sintered block, and after studying the size effect[1] on the g factor at each frequency, the resonance fields H_z were determined by extrapolating to zero diameter. These are shown in Table I. The g factor at each frequency, designated g^* in the table, was calculated by Kittel's formula,[2]

$$\nu=(\gamma^*/2\pi)H_z, \qquad (1)$$

where $\gamma^*=g^*e/2mc$. This g factor was found to depend on the frequency, approaching the value of $g^*=2$ at shorter wavelengths.

As Landé's factor is a materially constant factor, it should have the same value at any frequency. We, therefore, substituted

TABLE I. g^* calculated by Kittles' formula $\nu=(\gamma^*/2\pi)H_z$.

Material	Frequency (Mc/sec)	Resonance field H_z (oersteds)	g^*
$NiOFe_2O_3$	9450	2780	2.43
	18,400	5930	2.22
	23,500	7660	2.19
	47,000	15,870	2.12
$MnOFe_2O_3$	9450	3120	2.16
	18,400	6320	2.08
	23,500	8190	2.05
	47,000	16,620	2.02