solute values of the total L shell conversions obtained in various ways are given for the four $E2$ cases in Table II.

These results indicate that the agreement between experimental and theoretical L subshell conversion coefficients is very good, and until more complete computations are available, those already published by Gellman *et al.* may be used with considerable confidence for the identification of γ-transition multipolarities. A fuller account of these experiments will shortly be published elsewhere.

TABLE II. L conversion coefficients of $E2$ transitions.

Converting nucleus	L conversion coefficient: Theory	$\frac{\alpha_K \text{ expt}}{(K/L)_{\text{expt}}}$	$\frac{\alpha_K \text{th}}{(K/L)_{\text{expt}}}$
Ta^{181}	0.72	0.80	0.82
Os^{186}	0.81	0.60	0.73
Hg^{198}	0.014	0.014	0.015
Hg^{199}	0.56	0.32	0.47

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Nuclear Magnetic Resonance Modulation Correction

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PERLMAN and Bloom[1] have recently drawn attention to an important correction for finite modulation amplitude which must be applied to measured nuclear magnetic resonance second moments if accurate structural information is to be deduced. By an approximate method they were able to show that the true second moment S_2 is related to the measured value S_2' by the relation

$$S_2'=S_2+\tfrac{1}{3}h_m^2, \tag{1}$$

where h_m is the amplitude of the field modulation. Their approximation assumed that the modulation spreads the true absorption curve evenly over the range of modulation. The object of this note is to show that a direct calculation, without this approximation, leads to the same form of correction as Eq. (1), but that the coefficient of the last term is $\frac{1}{4}$ rather than $\frac{1}{3}$.

Suppose the true absorption line is described by a shape function $g(h)$, where $h=H-H_0$; H being the magnetic field and H_0 its value at the center of the line. The instantaneous signal voltage entering the "lock-in" amplifier is proportional to $g(h)$, and h will be given by

$$h=h_1+h_m\sin(\omega_m t),$$

where h_1 is the mean value of h and $\omega_m/2\pi$ is the modulation frequency. Expanding $g(h)$ by Taylor's theorem, the instantaneous voltage is therefore proportional to

$$g(h_1)+\sum_{p=1}^{\infty}\frac{h_m^p\sin^p(\omega_m t)}{p!}\left[\frac{d^pg}{dh^p}\right]_{h_1}. \tag{2}$$

The lock-in amplifier gives a reading proportional to the coefficient of $\sin(\omega_m t)$ in the Fourier series in which Eq. (2) is expressible. This coefficient is found to be

$$f(h_1)=\sum_{q=0}^{\infty}\frac{h_m^{2q+1}}{2^{2q}q!(q+1)!}\left[\frac{d^{2q+1}g}{dh^{2q+1}}\right]_{h_1}, \tag{3}$$

where q takes integral values. For $q=0, 1, 2$ the numerical coefficients in Eq. (3) are 1, 1/8, 1/192 in agreement with Pake.[2]

The output of the lock-in amplifier is thus proportional to $f(h)$. The experimental value of the second moment is then obtained[3] as

$$S_2'=\int_{-\infty}^{\infty}h^3f(h)dh\bigg/3\int_{-\infty}^{\infty}hf(h)dh. \tag{4}$$

We now substitute for $f(h)$ from Eq. (3) and then integrate each term by parts. We assume that $g(h)$ and all its derivatives are zero at the limits of integration, and that they go to zero more rapidly than $1/h^3$. We are then left with only two terms in the numerator and one in the denominator, giving

$$S_2'=\left[\int_{-\infty}^{\infty}h^2g(h)dh\bigg/\int_{-\infty}^{\infty}g(h)dh\right]+\tfrac{1}{4}h_m^2$$
$$=S_2+\tfrac{1}{4}h_m^2, \tag{5}$$

which is the result stated above.

It has been found by experience in this laboratory that the range of modulation $2h_m$ may be set at about a quarter of the line width without introducing appreciable error. The line width, defined as the interval between maximum and minimum of the first derivative, is usually about twice the rms width (root second moment). From Eq. (5) it is seen that an error of about 2 percent is thus incurred in the second moment.

The preceding argument is readily extended to give the relation between the experimental $2n$th moment S_{2n}' and the true value S_{2n}:

$$S_{2n}'=\sum_{q=0}^{n}\frac{(2n)!h_m^{2q}}{2^{2q}q!(q+1)!(2n-2q)!}S_{2n-2q}.$$

Thus for the fourth moment $(n=2)$,

$$S_4'=S_4+\tfrac{3}{2}S_2h_m^2+\tfrac{1}{8}h_m^4.$$

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Effect of Capture on the Slowing-Down Length of Neutrons in Hydrogenous Mixtures

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A QUANTITY used in the problem of the slowing down of neutrons in a given material is the so-called slowing-down length, L_s, which is defined as follows: If a monoenergetic point source emits neutrons of energy E_0 in an infinite medium composed of the material in question, then the slowing-down length is given by $L_s^2(E, E_0)=\frac{1}{6}\langle r^2(E)\rangle_{\text{Av}}$, where $r(E)$ is the distance of a neutron of energy E from the source, the average being taken over all neutrons of this energy. Fermi[1] has derived a rigorous expression for this quantity for the case of hydrogenous media under the assumptions that the nonhydrogen nuclei have infinite mass and that capture is absent. The purpose of this communication is to present a generalization of Fermi's result which takes account of the presence of capture in the medium but still retains the assumption of infinite mass for the nonhydrogen nuclei. The resulting change in the magnitudes of L_s due to capture has been computed for a specific case.

Fermi's expression can be obtained from the appropriate transport equation.[2] When capture is taken into account the scattering term $f(\mu_0; u, u')$ in the transport equation becomes

$$f(\mu_0;u,u')=(1/2\pi)c(u')e^{-(u-u')}\delta[\mu_0-e^{-\frac{1}{2}(u-u')}]$$
$$+(1/4\pi)[1-c(u)-g(u)]\delta(u-u'), \quad (1)$$

where $u=\log(E_0/E)$ and $\mu_0=\mathbf{\Omega}'\cdot\mathbf{\Omega}$, the unit vectors Ω' and Ω