TABLE I. Comparison of the values of x_0 from Eq. (3) with the actual values

$H(r)$	x_0(actual)	x_0 from Eq. (3)
$\frac{e^{-r}}{4\pi r^2}$	0.7104*	0.7083
$\frac{e^{-r}}{4-r}$	1	1**
$\frac{e^{-r^2/4}}{(4\pi)^{3/2}}$	0.8239***	0.8192

* To make this value of x_0 comparable with those for the other two kernels, one should change the scale so that $\langle r^2\rangle_{Av}$ is the same. Thus, 0.7104 should be multiplied by $\sqrt{3}$, giving 1.230.
** In this case the constant trial function is the exact solution of Eq. (1).
*** This value is due to G. M. Volkoff. An equivalent result has been obtained independently by S. Frankel and E. Nelson.

He has observed that in the case of the Milne kernel a good value for the extrapolated endpoint can be obtained by using a constant trial function. This procedure, when applied to a general kernel, leads to a simple formula for the extrapolated endpoint which is of some value in physical problems where the kernel is not known analytically. The formula also indicates those properties of the kernel which are most important in determining the extrapolated endpoint. If the asymptotic solution of Eq. (1) is written in the form

$$f(x)=a(x+x_0),$$

where x_0 is the extrapolated endpoint, we find

$$x_0 \geqq \frac{1}{6}\frac{\langle|x|^3\rangle_{Av}}{\langle|x|^2\rangle_{Av}}+\frac{1}{4}\frac{\langle|x|^2\rangle_{Av}}{\langle|x|\rangle_{Av}},\quad \langle|x|^n\rangle_{Av}=\int_{-\infty}^{+\infty}G(|x|)|x|^n dx. \quad (2)$$

The kernel $G(|x|)$ is sometimes given in terms of a "spherical geometry" kernel, $H(r)$, by the relation

$$G(|x|)=2\pi\int_{|x|}^{\infty}H(r)rdr.$$

Then

$$\langle|x|^n\rangle_{Av}=\frac{\langle r^n\rangle_{Av}}{(n+1)}=\frac{4\pi}{(n+1)}\int_0^{\infty}H(r)r^nr^2dr$$

so that Eq. (2) becomes

$$x_0 \geqq \frac{1}{8}\frac{\langle r^3\rangle_{Av}}{\langle r^2\rangle_{Av}}+\frac{1}{6}\frac{\langle r^2\rangle_{Av}}{\bar{r}}. \quad (3)$$

The accuracy of Eqs. (2) and (3) is indicated by Table I.

For kernels obtained by the convolution of a "Yukawa" and "Gaussian" kernel, the values of x_0, and the errors in (3) are intermediate between those indicated in the table for the two simple kernels.

* Based on Knolls Atomic Power Laboratory Report A-4249 dated September 5, 1947.

[1] R. E. Marshak, Phys. Rev. 71, 688 (1947).

Microwave Magnetic Resonance Absorption in Nitric Oxide

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WE have studied the magnetic absorption spectrum arising from transitions between the Zeeman components of a single rotational state of NO. The apparatus and technique have been briefly described in connection with a similar spectrum[1] observed in O_2.

As is well known, the NO molecule has a $^2\Pi$-ground state, and the molecular paramagnetism arises from the upper or $^2\Pi_{3/2}$ doublet component which is appreciably populated at room temperature. The spin-orbit coupling and doublet splitting are quite large in NO so that this coupling is not broken down by laboratory magnetic fields. Thus, in distinction to O_2, the main features of the magnetic absorption in NO are as predicted by the ordinary Zeeman theory. This theory[2] gives four magnetic levels separated by a constant energy interval $(4/5)\mu_0 H$ erg, for the lowest, $J=3/2$, rotational state of the upper doublet component. H and μ_0 are, respectively, the external magnetic field and the Bohr magneton. Magnetic dipole transitions, $\Delta m_J=\pm 1$, would give rise to a single absorption line at about 8360 gauss for the experimental frequency of 9360 mc/sec. Similar transitions for the $J=5/2$ state lie above the available field strengths for this frequency.

The observed spectrum consists of nine lines of about equal intensity arranged in a trio of triplets with an approximately constant spacing of 27 gauss between members of a triplet and an approximately constant spacing of 100 gauss between the triplet centers. The center of the pattern is at about 8660 gauss. The lines have equal half-widths of 4 to 5 mc/sec. at a pressure of 0.6 mm Hg. The measured absolute intensity of a single line is roughly 10^{-10} when expressed as the imaginary part of the magnetic susceptibility. This is in agreement with theory.

The nature of the nine-line spectrum has been tentatively explained as arising from a combination of molecular perturbations and nuclear spin effects. Hill[3] has calculated the effect of spin uncoupling by a magnetic field for molecules in doublet states. This effect produces a general shift of the pattern by about the observed amount but does not cause differences in level separations as large as those observed. Hill has also indicated the effects of magnetic perturbations by nearby rotational states. This may be the largest source of the observed level separation differences. As for the nuclear perturbations, several kinds should be present since N^{14} has a spin of unity and both magnetic dipole and electric quadrupole moments. There will be a total of twelve hyperfine levels for the $J=3/2$ rotational state. The IJ coupling with N^{14} might be expected to be fairly large because of the resultant molecular moment but still quite small as compared with the JH coupling. IH and electric quadrupole coupling are quite small. A combination of the molecular perturbations and IJ coupling gives a nine-line spectrum similar to that observed. There is some suggestion of non-interval spacing due to quadrupole coupling, but our present magnetic field stability must be improved to determine this quantitatively.

* Assisted by the ONR.

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A Particular Case in Einstein's Generalized Theory of Gravitation

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FOLLOWING Einstein's generalized theory of gravitation,[1] we have set up a total field of Hermitian quantities which reduced to the isotropic field of a point mass in classical relativity when the electromagnetic field is switched off, and which reduces to the uniform field of monochromatic radiation ($E_y=H_z=-\phi$, $E_x=E_z=H_x=H_y=0$, $\phi=A\cos 2\pi(x-t)/\lambda$) when the gravitational field is removed. For the Hermitian tensor $g_{ij}=a_{ij}+(-1)^{\frac{1}{2}}b_{ij}$ we have

$$a_{ii}=-\left(1+\frac{2m}{r}+\frac{3}{2}\frac{m^2}{r^2}+\frac{m^3}{2r^3}-h_{ii}\right),\quad i=1,2,3$$

$$a_{44}=1-\frac{2m}{r}+\frac{2m^2}{r^2}-\frac{3}{2}\frac{m^3}{r^3}+h_{44},\quad a_{ij}=h_{ij},\quad i\neq j \quad (1)$$

$$b_{12}=\alpha,\quad b_{13}=\phi+\beta,\quad b_{14}=\gamma,$$
$$b_{23}=\delta,\quad b_{24}=\epsilon,\quad b_{34}=\phi+\chi.$$

The electromagnetic potentials appear through

$$\alpha=-\Phi_{,3}-H_{,4},\quad \beta+\phi-2m\phi/r=G_{,4}+\Phi_{,2},$$
$$-\gamma=H_{,2}-G_{,3},\quad \delta=-\Phi_{,1}-F_{,4}, \quad (2)$$
$$-\epsilon=F_{,3}-H_{,1},\quad -\chi-\phi-2m\phi/r=G_{,1}-F_{,2},$$