TABLE I. Experimental counting rate.

Field	Shield	Counts/min.	Diff.
off	off	393	
			297
on	off	96.19±0.16	
			0.07±0.23
on	on	96.12±0.16	
on	off (-coinc.)	34.16±0.06	
			0.15±0.08
on	on (-coinc.)	34.01±0.06	

(0.21), the final efficiency of our arrangement with respect to x-rays is 0.19. As we are interested directly in the ratio x-rays/β-rays and not in the absolute intensities, we do not need apparently to consider a solid angle effect, both measurements of x- and β-rays being performed under identical geometrical conditions. We must, however, take into account the back-scattering of β-particles, an effect which had been neglected by Bleuler and Gabriel[3] and was first brought into consideration by Graf.[4] That implies in our experimental conditions, according to Graf's result, a correction factor on β-intensity of the order of 0.5.

Table I represents the results obtained in a total time of 123 hours.

We assume the difference of the first and second lines of Table I to represent the intensity of β-rays. This has been confirmed by a control experiment with the KF layer off. This intensity must be corrected for the back-scattering effect; using the correction factor 0.5 we obtain $I_\beta=0.5\times297=148$. The numbers in the fourth and fifth lines are obtained from those in the second and third by subtracting the coincidences of counter AB with counters C (cosmic rays background). The differences between the second and third or between the fourth and fifth lines give as upper limits (considering statistical errors) for the x-rays intensity 0.30 and 0.23, respectively, the second figure (corresponding to a reduced background) being the more reliable. For the ratio x-rays/β-rays, taking into account the counting efficiency and the Auger coefficient, we obtain

$$\frac{\lambda_K}{\lambda_-}\leq\frac{0.23}{148\times0.19\times0.12}=0.07$$

as an approximate upper limit.

For unavoidable reasons we could not protract our experiment long enough to obtain a substantial reduction in the statistical error and to be able to give a more explicit value of λ_K. When the experiment had been completed the paper by Sawyer and Wiedenbeck[8] appeared, where a ratio $\lambda_K/\lambda_-=0.13\pm0.04$ is given, in substantial agreement with our upper limit. The same conclusion, that λ_K/λ_- is at most of the order of 0.1, has also been obtained at the same time by Haxel, Heintze, and Houtermans, by a third different experiment.[9]

All of these experiments agree among themselves and with Suess' and Aldrich and Nier's geochemical determinations,[5] indicating for λ_K/λ_- a value at least 20 times smaller than Bleuler and Gabriel's value. We think that an actual quantitative determination of this ratio could best be performed by our method, more direct than the others attempted, using a layer of KF enriched with K^{40} by a factor of 10 or more. Further details of our experiment will be found in a paper to appear shortly in the *Nuovo Cimento*.

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Microwave Resonance Absorption of $NiOFe_2O_3$

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MICROWAVE resonance absorption in a semiconductor was first reported by Hewitt,[1] using MnO ZnO $2Fe_2O_3$. In the ferromagnetic ferrites, $NiOFe_2O_3$ has an especially high resistivity of 10^6 ohm-cm, when the heat treatment is suitable.[2] Since the absorption in a semiconductor is not so affected by the surface condition of specimen, it should be possible to measure the resonance field accurately. The measurements of resonance absorption were made in the range of 7.5-cm and 3.2-cm wave-length.

In Fig. 1, curve (A) shows the results of a measurement at 4051 Mc of the curve of high frequency loss *versus* the static magnetic field applied to the disk specimen (16 mm diam., 0.5 mm thick). The curve has a rather broad maximum, but after repeated measurements we were able to fix a maximum resonance field of 450 to 470 oersteds; when M_∞ for the specimen is known, the g-value can be calculated according to Kittel's formula[3] $\omega_0=\gamma(BH)^{\frac{1}{2}}$. By means of the isthmus method, a value of M_∞ of 307 gauss was obtained at 8000 oersted. This is in good agreement with the result obtained by Gorter.[4] The g-value was thus found to be 2.05 ± 0.07 with 307 gauss for M_∞.

As the r-f skin depth in the specimen is large, owing to its high resistivity, it is possible to measure the absorption by using a spherical specimen. As Kittel has shown, the resonance formula will be $\omega_0=\gamma H$ when the specimen is a sphere, and does not involve the observed value of M_∞ explicitly. The curve observed by using the spherical specimen (10 mm diam.) is shown by curve (B), and we obtained a g-value of 2.02 ± 0.10. This result is in good agreement with the case of the disk, with 307 gauss for M_∞.

Furthermore, the absorption was also observed with the disk specimen (4.5 mm diam., 0.5 mm thick) at 3.2-cm wave-length, 9317 Mc in frequency. The result is shown in curve (C). The maximum absorption was observed at 1810 oersted and a minimum absorption was also observed, the g-value was determined as 2.26 ± 0.02 considering a demagnetizing factor of $Ny-Nz=0.775$ which was calculated from the dimension of the specimen. Curve (D) is a resonance curve of a spherical specimen (2.2 mm diam.) and the g-value obtained was 2.26 ± 0.02. Beljers and Ploder[5] have reported the g-value of $NiOFe_2O_3$ as 2.23 (3 mm diam.) and 2.36 (2 mm diam.). We could not observe such a size effect by using spherical specimens of 2.2 mm and 3 mm in diameter. However, we can point out that it is difficult to observe the resonance

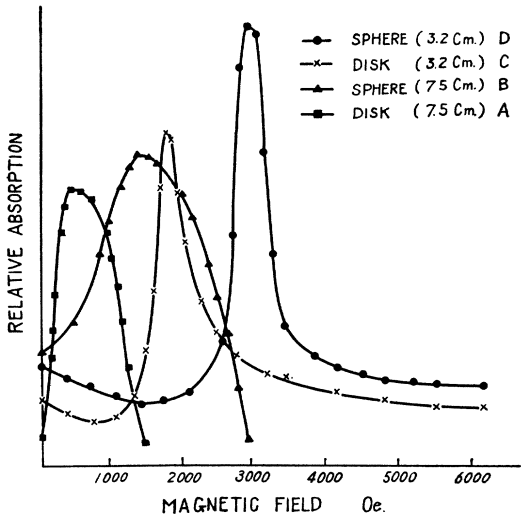

FIG. 1. Resonance curves of $NiOFe_2O_3$ at the wave-length of 7.5 cm and 3.2 cm.

TABLE I. g-Value of $NiOFe_2O_3$.

Form of specimen	Wave-length 7.5 cm	3.2 cm
Disk	2.05±0.07	2.26±0.02
Sphere	2.02±0.10	2.26±0.02

field accurately when the 3-mm sphere was used, owing to the marked drop of the Q-value of a resonance cavity.

The g-value of $NiOFe_2O_3$ obtained is shown in Table I.

It was ascertained experimentally that the wave-length becomes shorter as the g-value becomes greater. Kittel[6] has discussed such a frequency dependence on the g-value for some metals, but the phenomenon should be studied further using a semiconductor, which has a deeper skin-depth.

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Microwave Spectroscopic Evidence for Internal Rotation in Methyl Silane

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WHILE thermodynamic evidence for the existence of internal rotation in molecules is conclusive, there are some questions as to the nature of the hindering potential barrier. This has recently been emphasized by Blade and Kimball,[1] who introduced a shape parameter into an assumed potential barrier, and found that the best modern thermodynamic data were inadequate for distinguishing between widely different barrier shapes and heights. Raman and infra-red spectroscopic studies have also proved somewhat inconclusive—partly because of the limited resolution obtainable in the visible and infra-red regions of the spectrum. Fortunately, microwave absorption lines associated with different stages of torsional vibration can be resolved easily. By careful intensity measurements of these absorption lines, it seems possible to determine the energy levels and therefrom the barrier height and shape rather accurately.

Probably the lightest symmetric-top molecule which is capable of internal rotation and of absorbing in the microwave region is H_3C-SIH_3 (methyl silane). We find that the $J=0\rightarrow1$ transition of this molecule has the interesting appearance shown in Fig. 1a. Here the more highly excited levels of torsional oscillation are seen to be split into two components, in agreement with the theory of internal rotation.[2] The spectrum of the deuterated compound (Fig. 1b) has a similar appearance, except for the relative intensities of the two components of a doublet. The statistical weight associated with each of these components, which depends on the nuclear spin of the two sets of equivalent nuclei, can be found by calculating the weight for each end of the molecule separately, as if it were rotating with perfect freedom, and then multiplying the two weights together to get that for the state of hindered rotation.

In the notation of reference 2, the two components of the normalized statistical weight g_I are 3/4 and 3/8 for CH_3SiH_3, giving a total of 9/8, while for CH_3SiD_3 the component weights are 11/18 and 8/18, giving a total of 19/18. For molecules with large nuclear spins of the equivalent nuclei, the component weight factors g_I would be 1/3 and 2/3 respectively.

In order to study the splitting for molecules with over-all axial rotation, we examined the spectrum corresponding to the transition $J=1\rightarrow2$, $K=1\rightarrow1$. In agreement with the prediction of Koehler and Dennison for this case,[3] these torsional vibrational levels appeared to be split into *three* components.

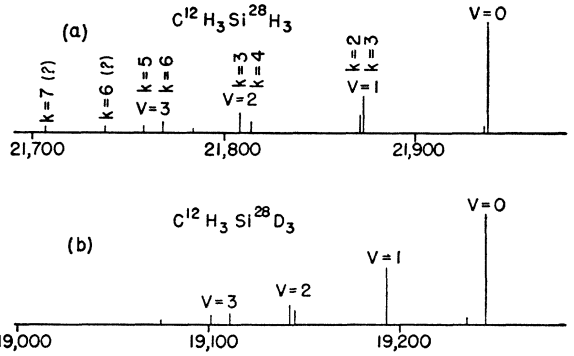

FIG. 1. The $J=0\rightarrow1$ transitions in methyl silane.

The rotational constants B_0 for different isotopic species of methyl silane are found to be:

$CH_3Si^{28}H_3$—10,968.96 Mc	$CH_3Si^{28}D_3$—9622.78 Mc
$CH_3Si^{29}H_3$—10,885.54 Mc	$CH_3Si^{29}D_3$—9572 Mc
$CH_3Si^{30}H_3$—10,806.53 Mc	$CH_3Si^{30}D_3$—9525 Mc.

Stark effect measurements show that this molecule has a dipole moment of 0.73 Debye.

Intensity measurements were attempted on absorption lines corresponding to different stages of torsional vibration and internal rotation. We used sinusoidal Stark effect modulation at 85 kc, two stages of 85 kc amplification, and then a calibrated r-f attenuator. Comparing two lines with the same statistical weight, the intensity ratio provided a measure of the corresponding energy level spacing, at the rate of 15.6 cm^{-1} per decibel of attenuation (temperature of dry ice). Preliminary values of the energy level spacings above the ground level are:

Level	$V=1$	$V=2$	$V=3$, $k=5$	$V=3$, $k=6$
Energy (cm^{-1})	183	313	415	465

These values are consistent with Blade and Kimball's two-parabola potential, where $V_0/V_{cos}=1$, $V_0=460\pm80$ cm^{-1}. With improvements to eliminate standing waves in the absorption cell, we believe that the barrier shape and height can be determined within 20 cm^{-1}.

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An Empirical Correlation Among Superconductors

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THE recent experimental results of Maxwell[1] and of Reynolds, Serin, Wright, and Nesbitt[2] on the change in the superconducting transition temperatures of Hg and Sn with change in isotopic mass has served to re-emphasize the important role of the lattice in determining electronic superconductivity, a feature of the phenomenon which was also evident from the marked observable effects of mechanical stress on the transition temperatures.[3] Moreover, these experiments on isotopic changes, being such that one clearly evident parameter is varied, afford an elegant check on theory, such as has been carried out for example recently by Bardeen[4] and Froehlich.[5]

On the other hand, the electronic character of the phenomenon also shows certain regularities among the superconducting pure metals and in view of the increased recent theoretical attention