Because of non-uniform crystallization, the source thickness appeared to be greater than 18.5 mg/cm² at some points. Both by measurement with an end-window counter, and from a calculation using a published value of the beta-ray decay constant, the strength of the sample was found to be about 0.002 μC.

Figure 1 shows the beta-ray intensity distribution plotted against momentum in gauss-cm. The curve has a maximum of 11.8 counts per minute against a background of 18.3 per minute. A Fermi plot taken from the experimental points is shown in Fig. 2. This is linear above 450 kev, and gives an end-point energy of 1.40 ± 0.03 Mev. Calibration was taken from the Fermi plot of P^{32} beta-rays measured under identical conditions except for source thickness. An upper energy limit of 1.71 Mev[10] was assumed for the phosphorus beta-rays. The annihilation quantum photoelectron line, previously mentioned, gave the same calibration figure within 1 percent.

The theoretical intensity distribution for K^{40}, corresponding to a Fermi plot linear over the entire range, is indicated in Fig. 1 by a dashed line. The point at 1130 gauss-cm (103 kev) is probably low because of absorption in the 3-mg/cm² counter window. The area under the experimental curve shows an excess of about 4 percent over the theoretical distribution.

The Fermi plot for P^{32} was also linear down to 500 kev and had a deviation of about the same shape and magnitude as in Fig. 2 for K^{40}. This would indicate that in both cases the excess of low energy electrons is mainly due to scattering which is difficult to eliminate under conditions of large solid angle and low resolution. It is therefore probable that the true K^{40} beta-ray Fermi plot would follow a straight line to considerably lower energies than observed here.

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Microwave Magnetic Resonance Absorption in a Nickel Salt near 1.25 Cm

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MAGNETIC resonance absorption at a frequency of 24,446 mc/sec. was observed in a crystal of nickel fluosilicate ($NiSiF_6 \cdot 6H_2O$) at room temperature as a function of the static magnetic field applied in directions parallel and perpendicular to the optic axis. The microwave technique enables a direct determination of values of the ground state splitting δ and splitting factor g, quantities previously inferred[1] from measurements of Becquerel and van den Handel[2] on the magneto-optic effect in this salt, and also from susceptibility measurements on other nickel salts.[3]

Our results are plotted in Fig. 1. For $H \parallel$ axis, we find $\delta=0.52$ cm^{-1}, $g=2.36$; for $H\perp$axis, $\delta=0.49$ cm^{-1} and $g=2.29$. The differences between these values are probably within the over-all experimental error. These values, which are for room temperature, may be compared with $g=2.252$ and $\delta=0.301$ cm^{-1} at liquid He temperatures, as calculated by Becquerel and Opechowski[1] from the measured Verdet constant. Schlapp and Penney[3] show that $g=2(1-2\lambda/5qD)$, where λ is the spin-orbit coupling constant and is equal to -335 cm^{-1} from spectroscopic data for the Ni^{++} ion; qD is the cubic field constant. Microwave measurements recently reported by the Oxford group[4] give $\delta=0.32$ cm^{-1} at 195°K, 0.17 cm^{-1} at 90°K, and 0.12 cm^{-1} at 20°K.

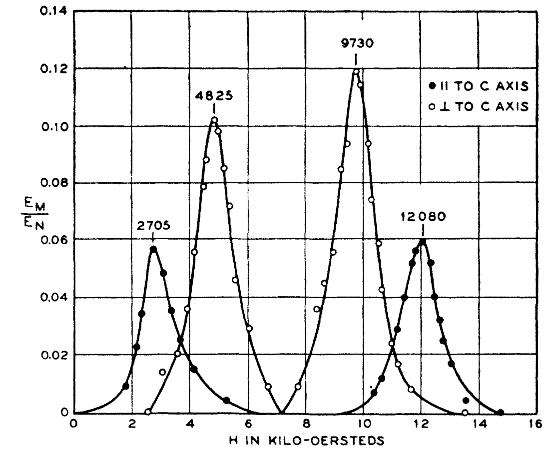

FIG. 1. Magnetic resonance absorption in $NiSiF_6 \cdot 6H_2O$ at 24,446 mc/sec. Vertical axis is ratio of (magnetic energy loss in sample) to (total non-magnetic energy loss in cavity and sample). Results are shown for two crystal orientations, parallel and perpendicular to the static field.

The free Ni^{++} ions is in a ^3F state; in the cubic electric field of the surrounding octahedron of water molecules, the non-degenerate orbital level Γ_2 is lowest. The threefold spin degeneracy of the ground level is partly lifted by the combined action of spin-orbit coupling and a small trigonal component of the crystal field. The relation between field strength and absorption frequency may be understood approximately by a "symbolic" method; namely, by considering the behavior of a level with $L=1$ in a cylindrical electric potential ($V=A[x^2+y^2-2z^2]$) and in a magnetic field H. We thus treat only three states, instead of the 21 states of the complete problem; the validity of this procedure is a consequence of group theory.

For $H \parallel$ axis, the three eigenvalues are $E_1=g\mu_B H$; $E_2=-g\mu_B H$; $E_3=\delta$; and the allowed transitions satisfy $g\mu_B H_{||}=h\eta\pm\delta$. For $H\perp$axis, $E_1=0$; $E_{2,3}=(\delta/2)\mp[(\delta/2)^2+(g\mu_B H)^2]^{\frac{1}{2}}$, which in the limit of $g\mu_B H\gg\delta$ gives $g\mu_B H=h\nu\pm\delta/2$.

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The Decay of Co^{55}

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THE decay of Co^{55} (18.2 hr.) has been studied by means of a large double focusing spectrometer[1] and by coincidence experiments. Samples were prepared by deuteron bombardment of iron. The cobalt was separated chemically. Small corrections for the radiations of the longer lived cobalt isotopes were made where necessary. The positron spectrum was found to be complex. There are two components[2] with maximum energies of 1.50 Mev and 1.01 Mev and about equal abundance. Another softer component of low abundance is possible. The