bits give a number of electrons per atom 0.82 ± 0.05, but this estimate is subject to modification due to the possibility of appreciable *d*-band conduction. For field directions giving rise to open orbits, a small transverse-even voltage is also observed as expected.[11]

We are indebted to V. J. Albano, C. L. Luke, E. Buehler, and J. H. Wernick, who developed the purification and crystal-growing procedures and supplied the nickel sample, and also to G. F. Brennert for assistance in the measurements.

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[2]No correction has been applied for anisotropic demagnetization, which would still have an appreciable effect at an applied field of 18 kG for this sample of length 14 mm and diameter 2.3 mm. This effect and slight misorientation of the sample are sufficient to explain the deviation by a few degrees of many of the peaks from exact coincidence with the symmetry planes.

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[7]The unusual behavior in all the field-dependence curves at fields ≲6 kG, roughly the saturation field intensity of nickel, is presumably associated with the magnetocrystalline anisotropy energy.

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[9]By slight modification of the nickel band structure calculated by J. G. Hanus (Massachusetts Institute of Technology Solid-State and Molecular Theory Group, Quarterly Progress Report No. 44, 1962), this topology can be made consistent with 0.5 $d\downarrow$ holes, 0.3 $s\uparrow$ electrons, and 0.2 $s\downarrow$ electrons yielding a net unpaired spin of 0.6 Bohr magnetons and the gyromagnetic ratio $g \simeq 2.0$. The slight modifications are that relative to the $d\downarrow$ band, the $s\uparrow$ and $s\downarrow$ bands are lowered by 0.03 ry and the $d\uparrow$ band is lowered by 0.05 ry. To give roughly the observed contact area at the symmetry point, L, of the Brillouin zone one requires $E_F - L_2' \sim 0.015$ ry [J. C. Phillips (private communication)].

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MAGNETOSTATIC HIGHER MODE RESONANCE IN A PARAMAGNET

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The study of paramagnetic resonance absorption in copper potassium chloride,[1,2] $K_2CuCl_4{\cdot}2H_2O$, has been extended to a temperature region down to 1.5°K. When the static magnetic field is applied along the [001] direction, all the copper ions in the unit cell become equivalent, though the unit cell contains two inequivalent copper ions, and only a single peak can be observed even at the highest frequency.

In our case the specimens used were ground to have approximately ellipsoidal shapes. At $\lambda = 1.30$ cm the linewidth was observed to be about 30 Oe at about 3°K; however, when the temperature was lowered it decreased to about 17 Oe at 1.5°K and the resonance field shifted toward the low field side by about 60 Oe. In addition, several small subsidiary peaks appear at the central part of the main peak. An example of the recorder traces observed at $T = 1.68$°K and at $\lambda = 1.30$ cm is shown in Fig. 1, in which the main peak is labeled m.

The splitting, δH_i, of the ith peak measured from the main peak increases with decreasing temperature; however, the ratio, $\delta H_i/\delta H_j$, of the splitting of the ith to the jth peak is constant with temperature. The origin of these small peaks was concluded to be the magnetostatic higher mode of oscillation in the paramagnet expected by Geschwind.[3] The main peak is due to the uniform precession of the moments within the specimen which corresponds to the Kittel mode in ferromagnetic resonance.[4] In this temperature region and at the resonance field (about 8 kOe), the total magnetization of the specimen may reach about half of its saturation value, so the effect of the demagnetization field cannot be neglected.

Walker discussed modes of oscillation of a ferromagnetic spheroid having an isotropic g tensor and calculated the resonance conditions for some

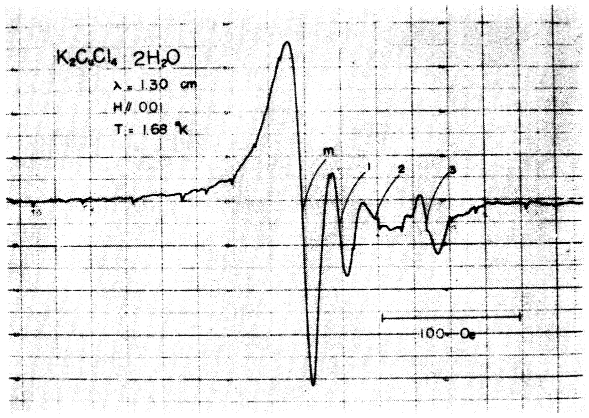

FIG. 1. An example of the recorder traces of the paramagnetic resonance in copper potassium chloride observed at $T = 1.68$°K when $H_0 \| [001]$ and $\lambda = 1.30$ cm.

of the simple magnetostatic modes.[3] The main results are applicable to the paramagnetic case and can be simply expressed as

$$\omega/\gamma = H_0 - 4\pi M_0(\Delta_i - N_z), \tag{1}$$

where H_0 is the applied magnetic field, Δ_i a numerical factor depending on the mode, N_z the reduced demagnetization factor along the applied field, and M_0 the total moment of the specimen.

Then δH_i should correspond to $4\pi M_0(\Delta_i - \Delta_m)$ and be proportional to χ, the static susceptibility of this crystal, as long as δH_i is much smaller than H_0. The plots of $1/\delta H_i$ as a function of T, the measuring temperature, gives a relation $(1/\delta H_i) \sim (T - \Theta)$, where the Weiss constant, Θ, of this crystal is concluded to be $\Theta = +0.9 \pm 0.15$°K. This Weiss constant agrees well with that of the static susceptibility measurements,[5] $\Theta = 1.05$°K, and the fact that this crystal becomes ferromagnetic below about 0.9°K.[6] Moreover, it is consistent with the results that the exchange energy, (J/k), between the copper ions within this crystal was measured to be about 0.3°K from the frequency dependence of the paramagnetic resonance line shape[1,2] and the magnitude and the tails of the magnetic specific heat measurements.[6]

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THERMOELECTRICITY IN IRRADIATED GLASS*

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(Received February 26, 1962; revised manuscript received August 20, 1962)

Thermally released charge displacements occuring in the absence of any externally applied electric field have been reported recently for gamma-[1] and x-irradiated[2] glasses. In some preliminary studies to be described here, room-temperature irradiations of Cabal-type[3] glasses with Co^{60} have been found to induce a similar effect when the irradiated samples are heated subsequently in temperature gradients of 20 to 40°C/mm. The 3-cm^2 by 0.318-cm thick samples sandwiched between parallel plate electrodes are heated by conduction through one of the electrodes. A typical electrometer current trace is shown in Fig. 1. The charge displacement below 320°C, i.e., the time integral of the electrometer current prior to its inversion, reaches a maximum of about 10^{-8} coulomb/cm^2 after a 25-hour exposure at a 10^5-rad/h incident dose rate. Rather large data scatter due to electrometer drift at elevated temperatures precludes the inclusion of the 370° current peak in any such analysis. A second heating of an irradiated sample produces no residual electrometer deflection.

From Table I it is seen that the total charge displaced below 320°C is directly proportional to the temperature gradient applied to the samples for the three gradients tested. Each value in Table I is the average of six individual measurements performed on the same glass sample irradiated repeatedly for 18 minutes at 10^5 rad/h. In no case has the standard deviation exceeded ten percent of the quoted value. It would appear from this proportionality that the emf for the charge displacement is of a thermoelectric origin, as

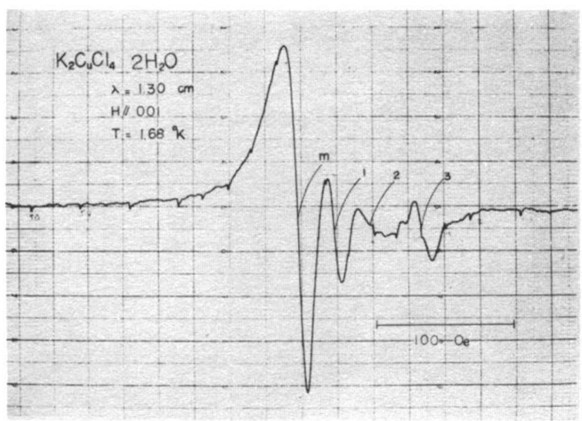

FIG. 1. An example of the recorder traces of the paramagnetic resonance in copper potassium chloride observed at $T = 1.68°K$ when $H_0 \| [001]$ and $\lambda = 1.30$ cm.