Using smoothed data based on published work,[6] "blind" demagnetizations of this kind using zero final field would have given correct results above 0.1°K, but below that temperature the dashed curve was obtained. It is not known, however, whether this degree of reproducibility is typical.

In the (dR/dQ) determinations the resistor itself acted as the heater, but this proved something of an oversimplification of the apparatus. It was only possible in any case because of the relatively small change of resistance with temperature which meant that the temperature difference (b) did not become serious; with an Allen Bradley 10-ohm resistor, which has a much higher slope, the measurements were difficult to control. It would have been an advantage to have incorporated a separate heater, constant in resistance, such as a constantan winding.

Figure 2 shows the temperature changes on magnetization and demagnetization of an iron alum specimen, using an Allen Bradley 10-ohm resistor, as traced by a recording millivoltmeter; subsequent heating periods, with the temperature of the resistor rising above that of the salt, are also shown. Apparatus of this kind is simple and rugged and shows a large amount of detail of behavior; it will be appreciated, for example, that a knowledge of the exact temperature of the salt immediately before demagnetization is valuable in leading to reproducible results.

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‡ Now returned to H. H. Wills Laboratory, University of Bristol, Bristol, England.

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The Specific Heat of Liquid He^3*

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The specific heat of saturated liquid He^3 containing less than 0.1 percent He^4 has been measured from 0.54°K to 1.7°K. The results were presented at the Third International Conference on Low Temperature Physics and Chemistry and are in general agreement with data reported there by two other groups of workers.[1]

The warmup rate $\dot{T}$ of liquid He^3 in a vacuum-jacketed $\frac{3}{4}$-cc copper sphere was measured as a function of N, the total number of moles of He^3 in the system. The He^3 was cooled below the surrounding He^4 bath temperature by pumping. The heat flux to the liquid $\dot{Q}$ was measured and a plot of $\dot{Q}/\dot{T}$ *versus* N yielded a straight line. The slope, when corrected[2] for vapor warming and for evaporation into the changing amount of vapor space within the sphere, equals the specific heat. This correction varied from 2.5±0.05 percent of C at 0.54°K to 40±1 percent at 1.7°K. With this method the effects of the noxious volume outside of the sphere and of the specific heat of the calorimeter are eliminated because they do not depend upon liquid level.

Measurements were made from 1.05°K to 1.7°K with $\dot{Q}$ supplied by an electrical heater. $\dot{T}$ was measured by the vapor pressure rise and averaged about 1° per hour. Each point is based on six warmups. The results are given in Table I.

Table I. Liquid He^3 specific heats measured with heater.

T°K	1.069	1.157	1.256	1.364	1.453	1.528	1.609	1.695
$C \frac{\text{cal}}{\text{mole deg}}$	1.06	1.12	1.19	1.25	1.35	1.44	1.46	1.54

Table II. Liquid He^3 specific heats measured without heater.

T°K	0.540	0.629	0.748	0.804	0.872	1.251
C/L deg^{-1}	0.109	0.110	0.110	0.107	0.111	0.123
$C \frac{\text{cal}}{\text{mole deg}}$	0.83	0.89	0.92	0.92	0.98	1.22

To reach lower temperatures, the heater was removed and $\dot{Q}$ derived from the measured normal heat leak. The sphereas w filled with iron ammonium alum at 55 percent packing for temperature measurement by the standard ballistic method. The salt was calibrated above 1°K against the Argonne He^3 vapor pressure equation.[3]

The average heat leak was determined from: ΔN, the number of moles of He^3 pumped during cooldown between successive warmups over the same 0.05° interval; the time between identical temperatures on these warmups; and the average latent heat over the interval. A correction was applied to the observed average heat flux for the measured 2 percent reduction in flux during cooldown. Since $\dot{Q} \propto L$, only C/L is measured directly. For L we used values calculated from an equation fitting preliminary vapor pressures measured down to 0.5°K. Each point is based on at least twelve warmups. The results are given in Table II.

Entropy differences in the range 0.5 to 1.7°K can be calculated from these data. When combined with our preliminary vapor pressure data we find the value of entropy at 0.50°K to be 1.38 ±0.04 cal mole^{-1} deg^{-1}. By coincidence this is just equal to the nuclear spin entropy, $R \ln 2$. Data from a few warmups starting at 0.4°K indicate that the entropy has decreased to 1.20±0.06 at 0.4°K, a value significantly below $R \ln 2$. Hence, as qualitatively predicted by Pomeranchuk,[4] nuclear spin alignment must begin at or above 0.5°K, and a melting-pressure minimum would be expected at this temperature. The reported[3] apparent constancy of melting pressures below 0.5°K is consistent with the existence of a minimum, since the blocked-capillary technique used could not detect a rise in melting pressures below the temperature of a minimum.

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Directional Properties of the Cyclotron Resonance in Germanium*

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Cyclotron resonance[1] has been observed at 8895 Mc/sec in relatively pure n-type and p-type germanium at liquid helium temperatures. The samples studied were rods of approximately 1 mm square cross section, placed in the center of a rectangular cavity $\frac{3}{2}$ wavelength long. The sample occupied nearly the full height of the cavity with the rod axis in the direction parallel to the rf electric field. A transverse dc magnetic field was applied to the sample. The axis of the rod was cut along a [110] direction, so that by rotating the sample, the magnetic field could be lined up with all directions in the (110) plane, including a [100], a [111], and a [110] direction.

The resonance data were taken as a function of magnetic field, by means of an automatic recording system. The rf power down