from Landolt Bornstein III 19a

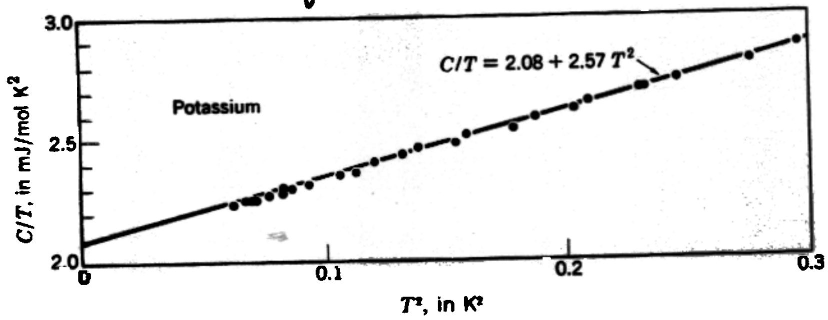

Figure 6 Experimental heat capacity values for potassium, plotted as C/T versus T^2. The solid points were determined with an adiabatic demagnetization cryostat. [After W. H. Lien and N. E. Phillips, Phys. Rev. 133, A1370 (1964).]

Table 1. Low-temperature specific heat coefficients and Debye temperatures for Fe, Co, and Ni [65 D 1]. Fe and Ni: least-squares fit to $C_p=\gamma T+\beta T^3+\alpha T^{3/2}$. Co: least-squares fit to $C_p=\gamma T+\beta T^3+\varkappa/T^2$, where $\varkappa/T^2$ is a nuclear contribution. $\beta=12\pi^4 N_A k_B/5\Theta_D^3$, N_A: Avogadro's number.

	γ mJ K^{-2} mol	β mJ K^{-4} mol^{-1}	α mJ K$^{-5/2}$ mol^{-}	Θ_D K
Fe	4.755(15)	0.0184(7)	0.021(12)	472.7(60)
Co [1]	4.38(1)	0.0199(7)		460.3(77)
Ni	7.039(16)	0.0179(7)	0.011(13)	477.4(62)

[1] $\varkappa=4.99(6)$ mJ K mol^{-1}

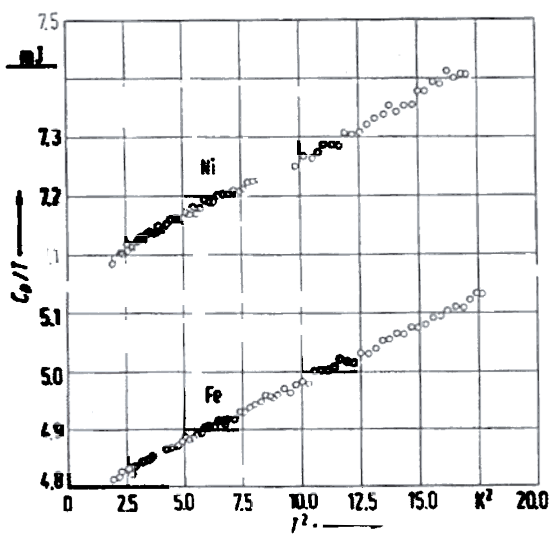

Fig. 5. Variation of C_p/T vs. T^2 of Fe and Ni at low temperature. Evaluating γ and β from $C_p=\gamma T+\beta T^3$ gave $\gamma=4.780(1)$ mJ K^{-2} mol^{-1} and $\theta_D=463.7(11)$ K for Fe and $\gamma=7.059(1)$ mJ K^{-2} mol^{-1} and $\theta_D=459.4(18)$ K for Ni [65 D 1].

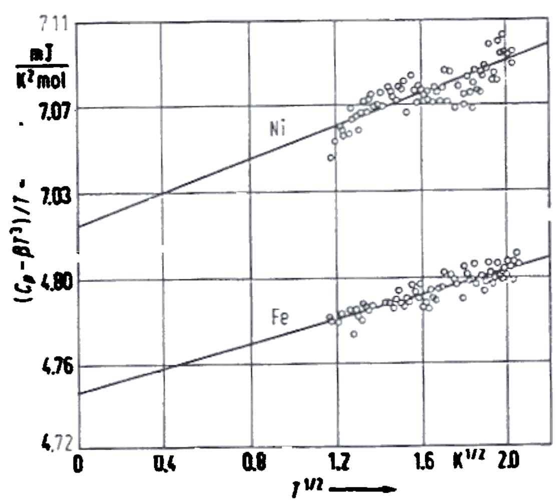

Fig. 6. Variation of $(C_p-\beta T^3)/T$ vs. $T^{1/2}$ of Fe and Ni at low temperature. Evaluating γ and α, the spin wave coefficient, from $C_p=\gamma T+\beta T^3+\alpha T^{3/2}$, where the lattice contribution was determined from the elastic constants, gave $\gamma=4.746(3)$ mJ K^{-2} mol^{-1}, $\alpha=0.028(2)$ mJ K$^{-5/2}$ mol^{-1} for Fe and $\gamma=7.014(5)$ mJ K^{-2} mol^{-1}, $\alpha=0.038(3)$ mJ K$^{-5/2}$ mol^{-1} for Ni (65 D 1].

 from Ashcroft & Mermin

The prediction of a linear specific heat is one of the most important consequences of Fermi-Dirac statistics, and provides a further simple test of the electron gas theory of a metal, provided one can be sure that degrees of freedom other than the electronic ones do not make comparable or even bigger contributions. As it happens, the ionic degrees of freedom completely dominate the specific heat at high temperatures. However, well below room temperature their contribution falls off as the cube of the

Table 2.3
SOME ROUGH EXPERIMENTAL VALUES FOR THE COEFFICIENT OF THE LINEAR TERM IN T OF THE MOLAR SPECIFIC HEATS OF METALS, AND THE VALUES GIVEN BY SIMPLE FREE ELECTRON THEORY

ELEMENT	FREE ELECTRON γ (in 10^{-4} cal-mole^{-1}-K^{-2})	MEASURED γ (in 10^{-4} cal-mole^{-1}-K^{-2})	RATIO* (m^*/m)
Li	1.8	4.2	2.3
Na	2.6	3.5	1.3
K	4.0	4.7	1.2
Rb	4.6	5.8	1.3
Cs	5.3	7.7	1.5
Cu	1.2	1.6	1.3
Ag	1.5	1.6	1.1
Au	1.5	1.6	1.1
Be	1.2	0.5	0.42
Mg	2.4	3.2	1.3
Ca	3.6	6.5	1.8
Sr	4.3	8.7	2.0
Ba	4.7	6.5	1.4
Nb	1.6	20	12
Fe	1.5	12	8.0
Mn	1.5	40	27
Zn	1.8	1.4	0.78
Cd	2.3	1.7	0.74
Hg	2.4	5.0	2.1
Al	2.2	3.0	1.4
Ga	2.4	1.5	0.62
In	2.9	4.3	1.5
Tl	3.1	3.5	1.1
Sn	3.3	4.4	1.3
Pb	3.6	7.0	1.9
Bi	4.3	0.2	0.047
Sb	3.9	1.5	0.38

* Since the theoretical value of γ is proportional to the density of levels at the Fermi level, which in turn is proportional to the electronic mass m, one sometimes defines a specific heat effective mass m^* so that m^*/m is the ratio of the measured γ to the free electron γ. Beware of identifying this specific heat effective mass with any of the many other effective masses used in solid-state theory. (See, for example, the index entries under "effective mass.")