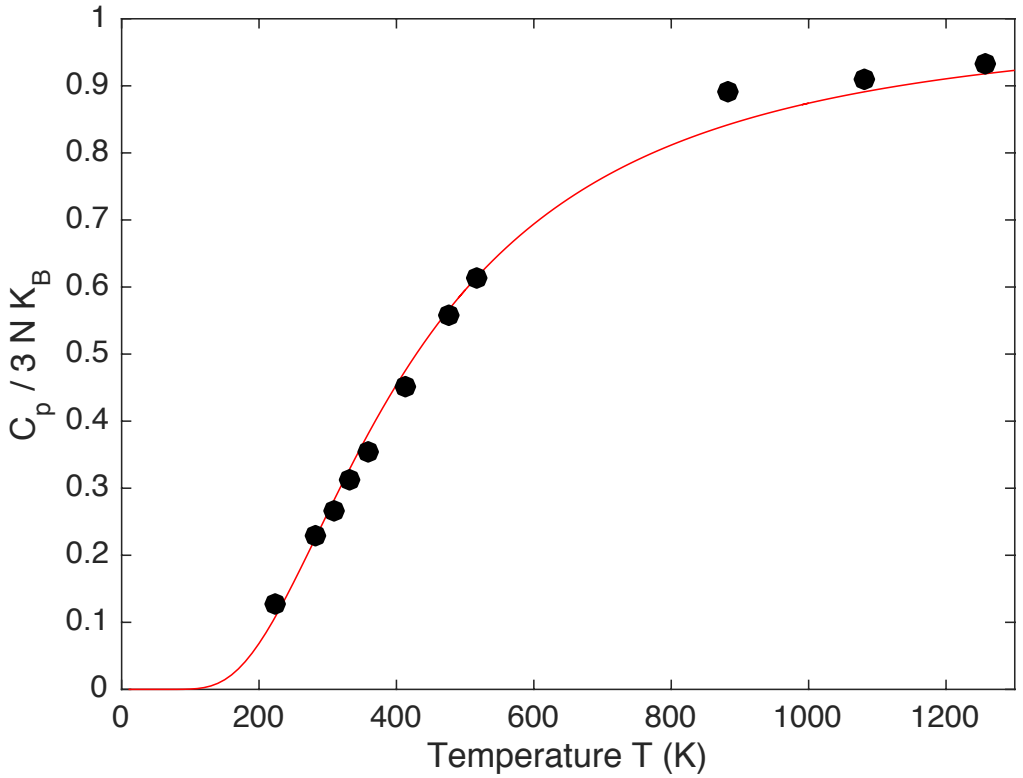
Today's Lecture: Heat Capacity

1. Einsteins Model for heat capacity
2. Debye's Model for heat capacity
3. How to measure heat capacity
4. Thermal conductivity

Heat Capacity: Diamond (as of 1906)



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Heat Capacity: Argon

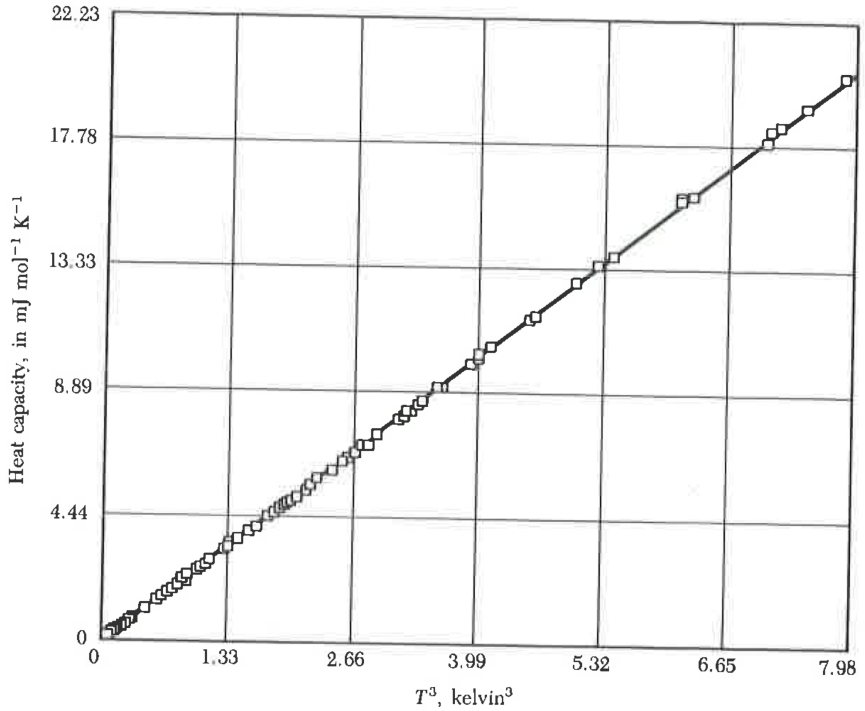

Figure 9 Low temperature heat capacity of solid argon, plotted against T^3. In this temperature region the experimental results are in excellent agreement with the Debye T^3 law with $\theta = 92.0$ K. (Courtesy of L. Finegold and N. E. Phillips.)

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Low-Temperature Heat Capacities of Solid Argon and Krypton*

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(Received 3 August 1968)

Debye Temperatures

TABLE 1 Debye Temperature and Thermal Conductivity[a]

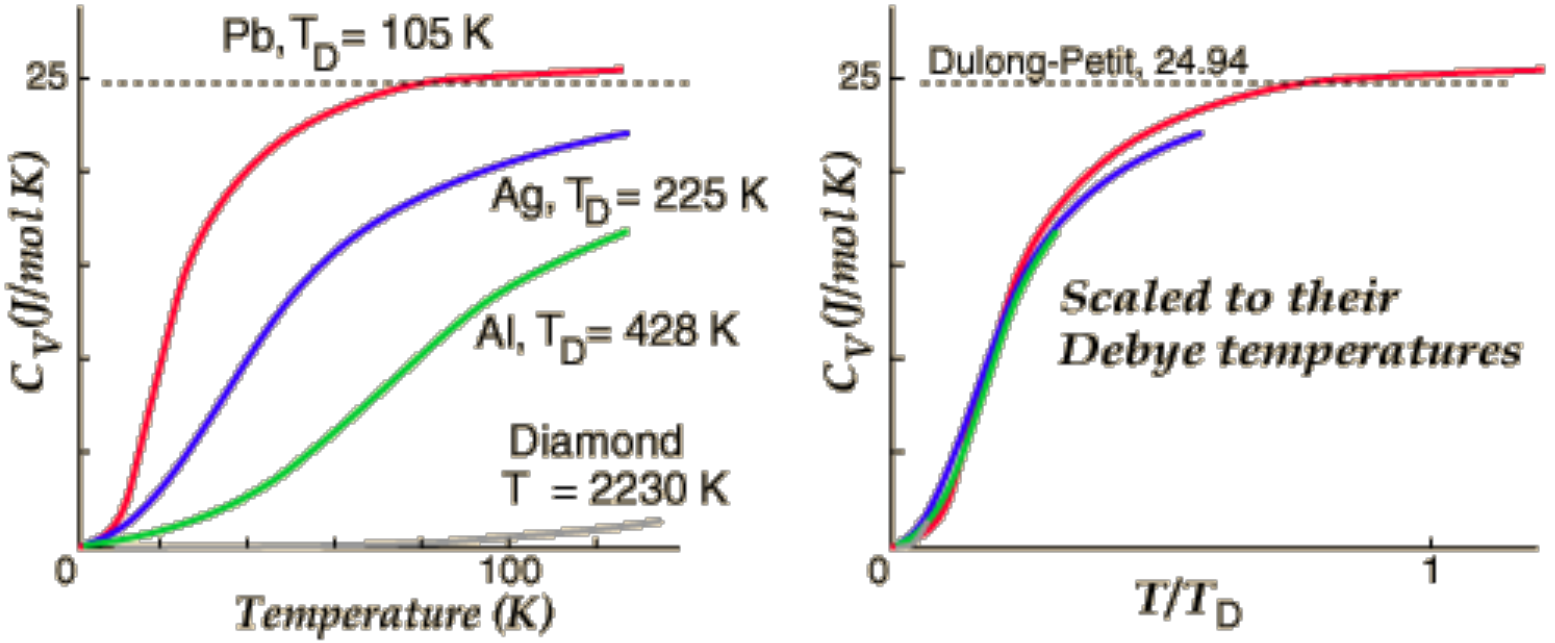
Low temperature limit of θ, in Kelvin
Thermal conductivity at 300 K, in W cm^{-1}K^{-1}

Li 344 0.85	Be 1440 2.00											B 0.27	C 2230 1.29	N	O	F	Ne 75
Na 158 1.41	Mg 400 1.56											Al 428 2.37	Si 645 1.48	P	S	Cl	Ar 92
K 91 1.02	Ca 230	Sc 360. 0.16	Ti 420 0.22	V 380 0.31	Cr 630 0.94	Mn 410 0.08	Fe 470 0.80	Co 445 1.00	Ni 450 0.91	Cu 343 4.01	Zn 327 1.16	Ga 320 0.41	Ge 374 0.60	As 282 0.50	Se 90 0.02	Br	Kr 72
Rb 56 0.58	Sr 147	Y 280 0.17	Zr 291 0.23	Nb 275 0.54	Mo 450 1.38	Tc 0.51	Ru 600 1.17	Rh 480 1.50	Pd 274 0.72	Ag 225 4.29	Cd 209 0.97	In 108 0.82	Sn α 200 0.67	Sb 211 0.24	Te 153 0.02	I	Xe 64
Cs 38 0.36	Ba 110	La β 142 0.14	Hf 252 0.23	Ta 240 0.58	W 400 1.74	Re 430 0.48	Os 500 0.88	Ir 420 1.47	Pt 240 0.72	Au 165 3.17	Hg 71.9	Tl 78.5 0.46	Pb 105 0.35	Bi 119 0.08	Po	At	Rn
Fr	Ra	Ac															

Ce 0.11	Pr 0.12	Nd 0.16	Pm	Sm 0.13	Eu	Gd 200 0.11	Tb 0.11	Dy 210 0.11	Ho 0.16	Er 0.14	Tm 0.17	Yb 120 0.35	Lu 210 0.16
Th 163 0.54	Pa	U 207 0.28	Np 0.06	Pu 0.07	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

[a] Most of the θ values were supplied by N. Pearlman; references are given the *A.I.P. Handbook*, 3rd ed, the thermal conductivity values are from R. W. Powell and Y. S. Touloukian, Science **181**, 999 (1973).

Heat Capacity for different elements



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Heat Capacity: Experimental setup

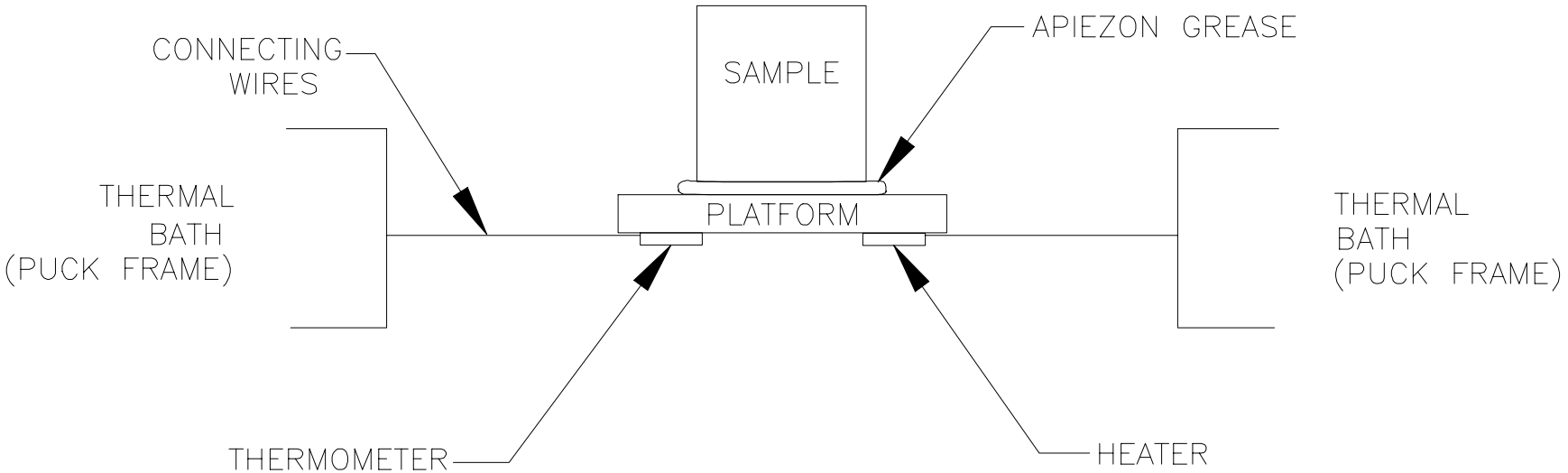

Figure 1-1. Thermal Connections to Sample and Sample Platform in PPMS Heat Capacity Option

Thermal Conductivity: NaF

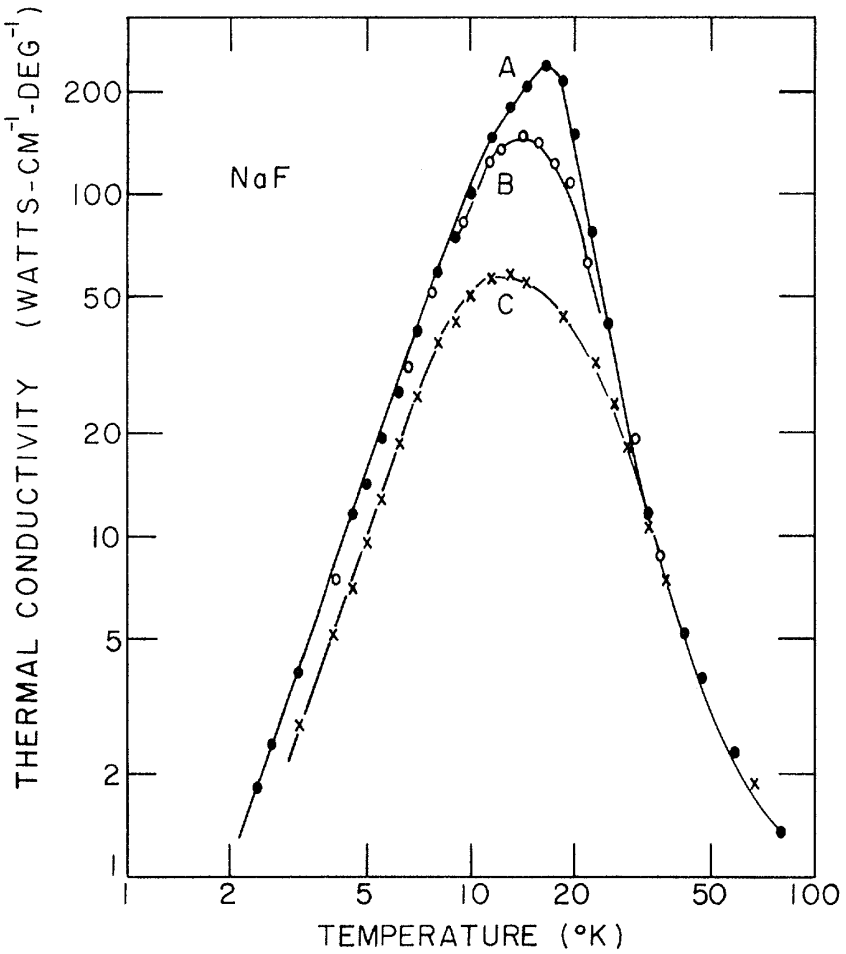

FIG. 1. Thermal conductivity versus temperature for pure NaF crystals. Curve *A*, NaF sample, this paper; curve *B*, NaF sample, Ref. 1; curve *C*, typical singly grown NaF (smaller cross section).