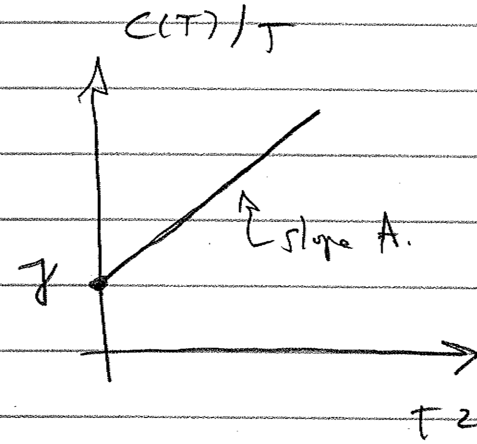
Specific Heat of a Metallic Solid

It is an experimental observation that for a metallic solid the specific heat is

$$C(T) = \gamma T + A T^3$$

This is usually emphasized graphically by plotting $C(T)/T$ vs T^2

$$C(T)/T = \gamma + A T^2$$



Our goal is to understand the AT^3 contribution.

We will come back to γT after discussing electron motion in a metal

Specific heat definition

$C = d\langle E\rangle / dT$

increase T
eg particles move faster, more KE

alternate view $\quad d\langle E\rangle = C\, dT$

how much does energy change $\quad$ in response to change in temperature ?

physics is full of response functions

$\chi = d\langle M\rangle / dB$ $\quad$ magnetic susceptibility

$d\langle M\rangle = \chi\, dB$

$dI = \Sigma\, dV$ $\quad$ (Conductivity $\Sigma = 1/R$)

$dI = \Sigma\, dV$

At a phase transition the response function often diverges.

If a system is about to become a spontaneous magnet

($M \neq 0$ even for $B=0$) then χ is <u>enormous</u>

SH-3

Specific heat of monatomic ideal gas?

$\langle E \rangle = \frac{3}{2} N k_B T$

$C = \frac{3}{2} N k_B$ ← T independent constant

Basic principle/rule of statistical Mechanics (Boltzmann)