Statistical Mechanics
Protons in a magnetic field, $B_0$, exist in one of two energy states which we called $E_\alpha$ and $E_\beta$ previously. The energy of the two states are

$$E_\alpha = -g \beta N B_0 / 2 \quad \text{and} \quad E_\beta = g \beta N B_0 / 2.$$ 

What is the ratio between the number of protons in these two states, $N_\alpha$ and $N_\beta$ at a temperature of 298 K in a 7 T field?
Partition function

- Partition function for a proton in an external magnetic field.

- Energy for a proton in an external magnetic field
Partition function

- Limiting behavior
  - $T$ approaches zero
  - $T$ approaches infinity
Heat capacity of atomic solid

- Correct modeling of heat capacity of atomic solid a major triumph for statistical mechanics

- Heat capacity modeled as a vibration of the atoms in the atomic lattice

- Partition function
Heat capacity of atomic solid

$<E>$
Heat capacity of atomic solid

$C_V$
Heat capacity of atomic solid

- Limiting behavior
  
  - $T$ approaches zero

  - $T$ approaches infinity