Lecture 6

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1 Postulate

The picture (not proof) behind the postulate is "true randomness" in the behaviour of large N systems.

- Consider an isolated gas with energy E. With 10^{23} particles, there are many ways for the energy to be distributed
- Collisions change the way energy is distributed, i.e. microstates
- We assume any such states are as likely as the other

We give up a mechanical description for statistics and probability, which is easier.

2 Electronic Paramagnet

We have N sites, and we only care about the total magnetic spin. The states are totally determined by $\{s_1, \ldots, s_n\}$, where s_i takes the value of ± 1. We neglect interaction between spins. Now the energy is described as

$$U = -\vec{\mu} \cdot \vec{B}$$

where U describes the potential energy, hence the negative sign. Total energy is hence

$$U = \sum_{i=1}^{N} -\mu_0 s_i B = -\mu_0 B \sum_{i=1}^{N} s_i$$

Then energy only depends on sum of spins. Now total spin

$$S = \sum_{i=1}^{N} s_i$$

takes all values from $-N$ to N in increments of 2 (flipping a spin changes S by 2). Now there are $N + 1$ macrostates but 2^N microstates. Now, we call a microstate "accessible" to a macrostate when the microstate corresponds to the macrostate. In this case, it is all combinations of s_i which add up to the same S, which is essentially n choose k.