PHYS 177
winter 2019

lecture 10: statistical physics

learning goals
- write down a Gibbs distribution and use it in calculations

microstates give a complete description of a system, labeled by vector $\underline{s}$

following the ergodic hypothesis, over long times

$$P(\underline{s}) = \frac{e^{-E(\underline{s})/kT}}{Z}$$

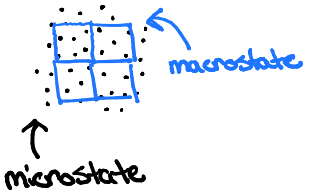
Z ← partition function $= \sum_{\underline{s}} e^{-\beta E(\underline{s})}$

to get macroscopic quantities, we need to average over microstates

$$\langle f(\underline{s}) \rangle = \sum_{\underline{s}} f(\underline{s}) P(\underline{s})$$

which gives results at equilibrium

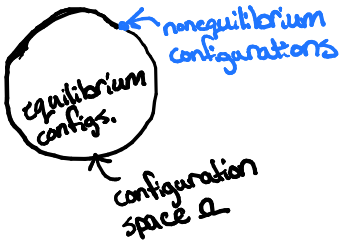
* but what is equilibrium? gas particles in the room have defined x and v, not $P(\underline{s})$



many microstates can belong to same macrostate

in reality, in equilibrium = belonging to the macrostate that characterizes equilibrium (from Gibbs distribution)

* how can we "approach" equilibrium if dynamics are reversible?



approach to equilibrium is statistical: dynamics take us through configuration space, and almost all configurations correspond to equilibrium macrostates

* notebook example, noninteracting spins in an external magnetic field