Key points of 01/24 lecture:

- Volume in phase space occupied by the microcanonical ensemble (number states consistent w/ macro variables):

$$\Gamma(E) = \int_{E < \mathcal{H} < E+\Delta E} d^{3N}\vec{p}\, d^{3N}\vec{q}$$

- Volume in phase space enclosed by the energy surface of energy:

$$\Sigma(E) = \int_{\mathcal{H} < E} d^{3N}\vec{p}\, d^{3N}\vec{q}$$

- $\Gamma(E) = \Sigma(E+\Delta E) - \Sigma(E)$

- $\Sigma(E+\Delta E) \approx \Sigma(E) + \dfrac{\partial \Sigma(E)}{\partial E} \Delta E + \ldots$

$\omega(E)$: density of states of the system at energy E

- $$\frac{1}{T} = \left(\frac{\partial S}{\partial E}\right)_{V,N} = \left(\frac{\partial}{\partial E}\left(k \log(\Gamma(E))\right)\right)_{V,N} = k \, \frac{\left(\frac{\partial \Gamma(E)}{\partial E}\right)_{V,N}}{\Gamma(E)}$$

$$\sim k \, \frac{\Delta \Gamma(E)}{\Gamma(E)} \, \frac{1}{\Delta E}$$ "fractional change of # of states per ΔE"

- If # of energy states is finite, increasing E can decrease # of accessible states → negative energy!