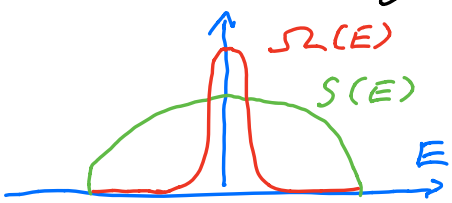
Wang-Landau Algorithm (Entropic Sampling)

Simulate microcanonical potential

$S(E) = \ln \Omega(E)$



Relative probability to randomly create state E vs. E':

$P(E')/P(E) = \Omega(E')/\Omega(E) = e^{(S(E') - S(E))}$

$\therefore$ Could obtain $\Omega(E)$ by random sampling (up to unknown factor)

How to improve sampling away from peak of $\Omega(E)$?

W-L Algorithm:

init.
- Guess some $S(E)$ (e.g. $S(E) = 0$)
- Create arbitrary initial configuration c with energy E
- Set $\delta = \ln e = 1$

Reinit.
- Zero out a histogram $H(E)$

Flatten
- Create new config c' with energy E' (by a spin flip or any other method)
- Accept $c' \to c$ with probability $e^{(S(E) - S(E'))}$ $= \Omega(E)/\Omega(E')$ if $S(E)$ is exact, thus cancelling $P(E')/P(E)$, and favoring low entropy energies
- If accepted, increment $S(E_f)$ by δ
- Increment $H(E_f)$ by 1 ($E_f = E$ or E')

- Reduce $\delta \to \delta/2$

Green loop: until $H(E)$ "flat enough" $\Rightarrow$ visit full range of E

Pink loop: until $S(E)$ converges (up to added constant)