A Tale of Balls & Boxes

or: Quenching the Zeta Urn Model

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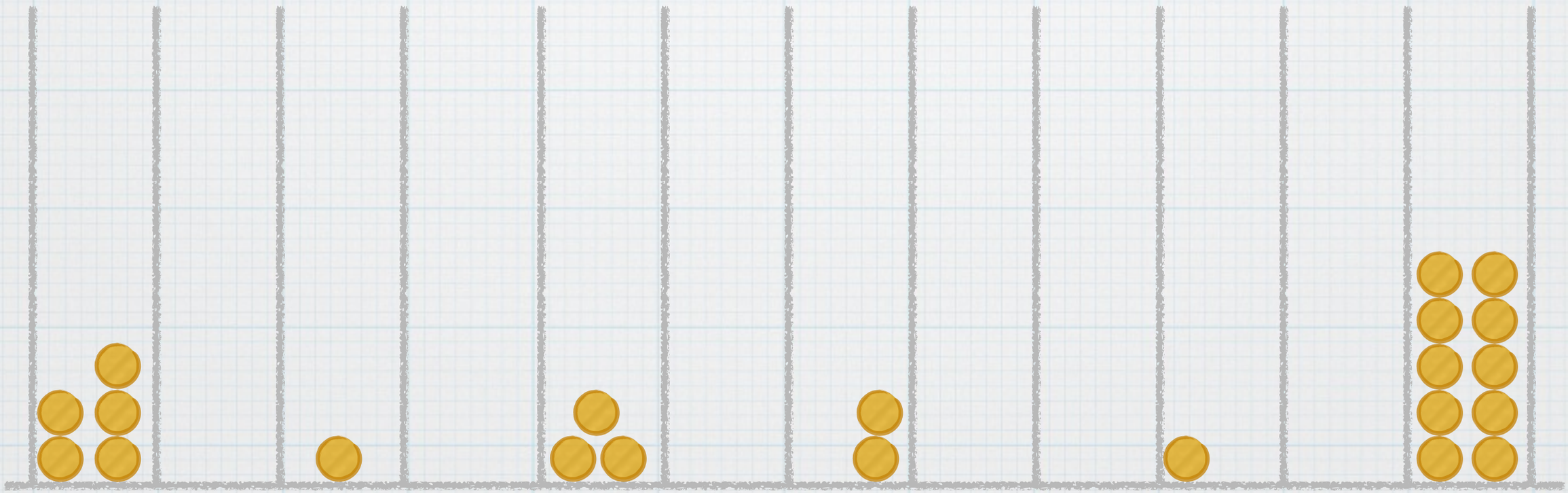
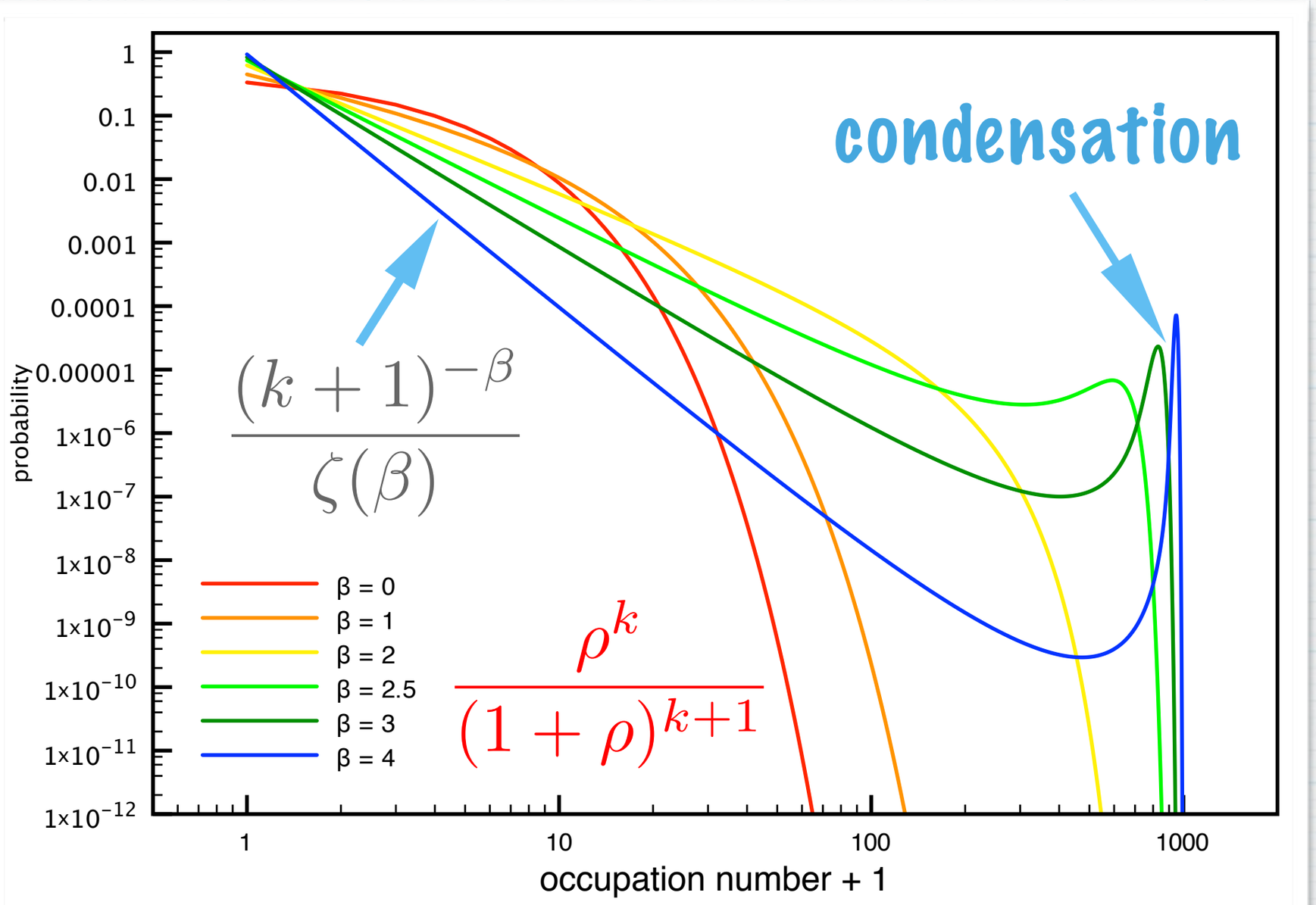


The rules

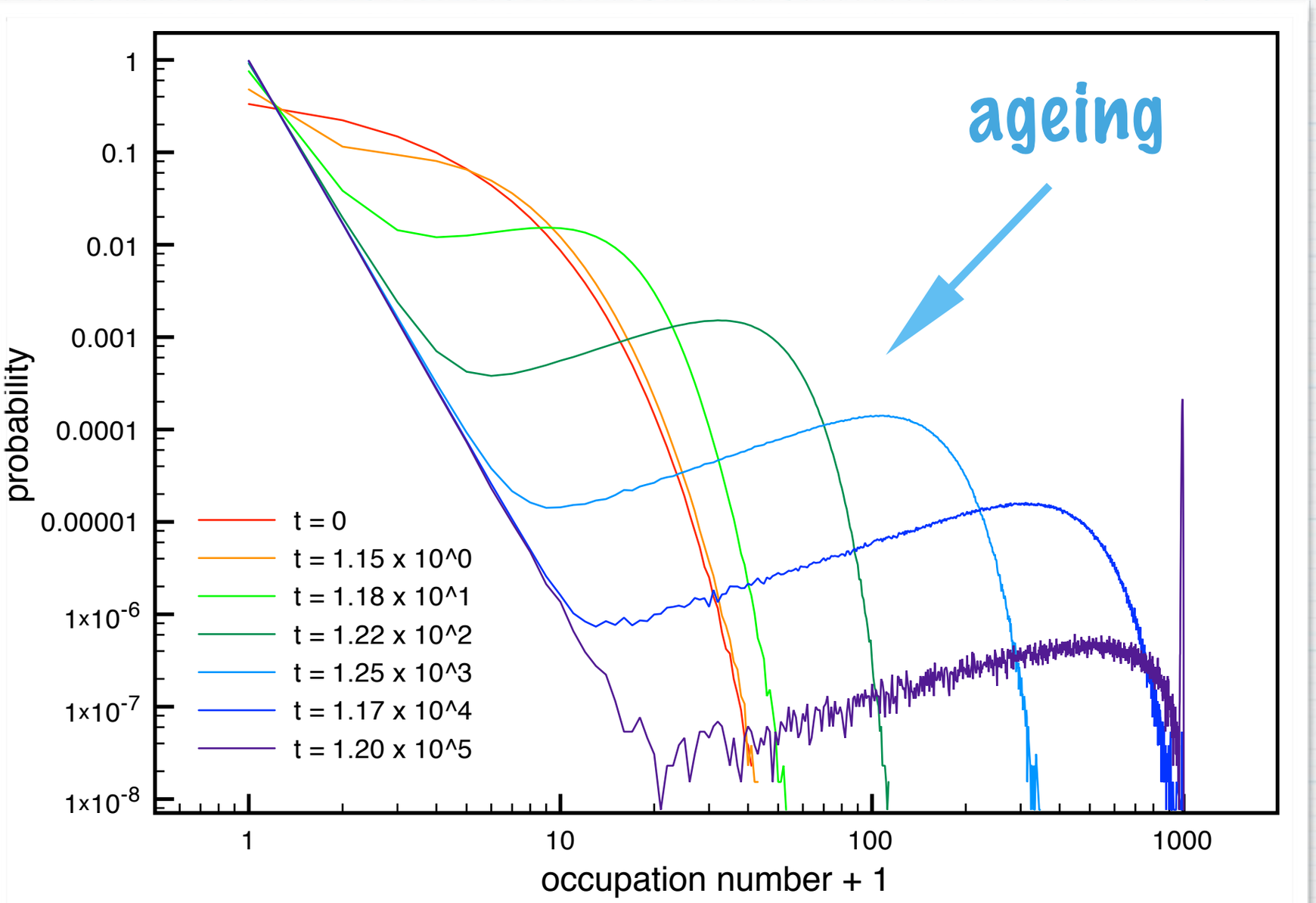
* N balls, M boxes
* randomly select one non-empty box A
* randomly select one different box B
* move 1 ball from A to B with probability that depends on exp(-β ΔE)
* $E(\{N_i\}) = \sum_{i=1}^{M} E(N_i) = \sum_{i=1}^{M} \ln(1+N_i)$
* thermodynamic limit: N→∞, M→∞, while ρ=N/M is fixed

Equilibrium properties



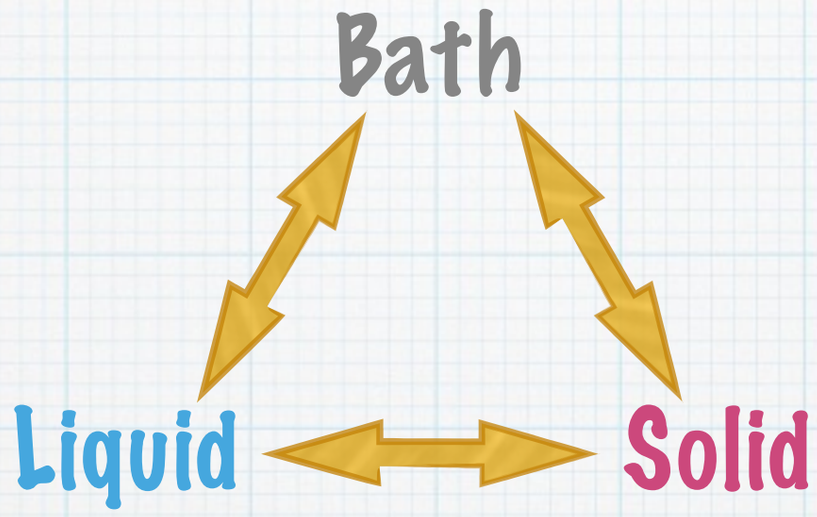
Equilibrium probability distribution of the occupation number of one box (N=1000, M=500)

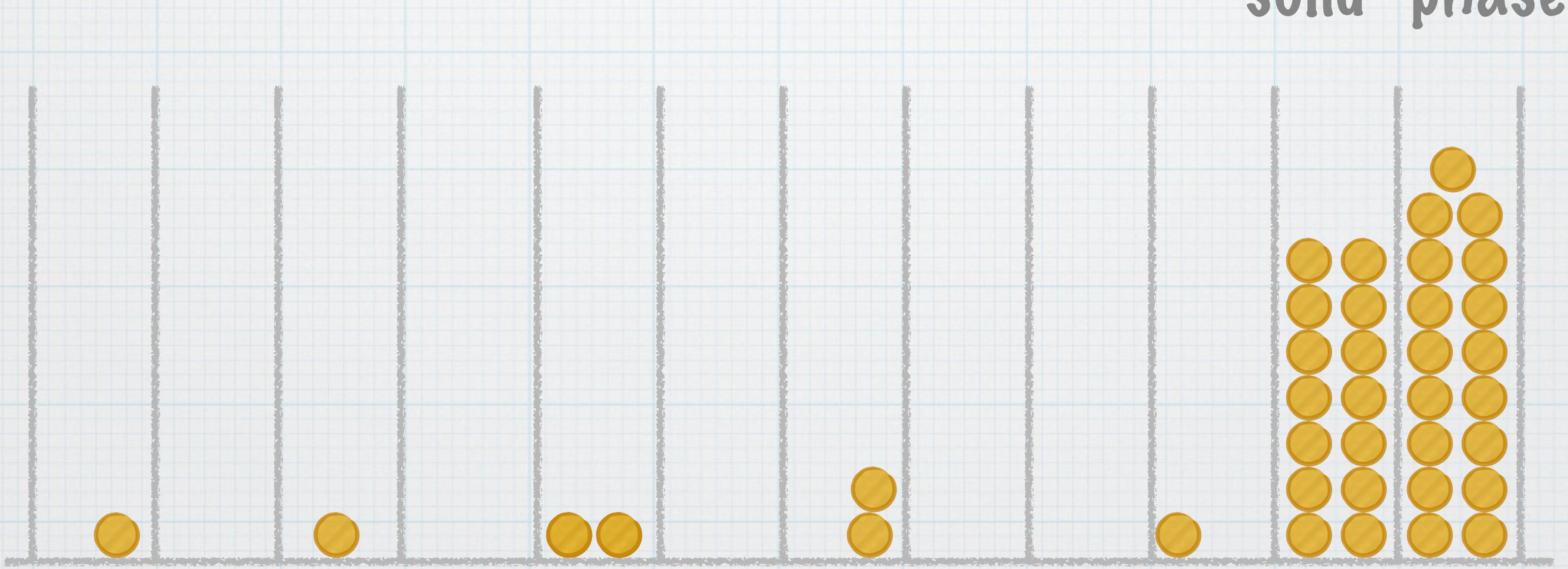
Nonequilibrium dynamics



MonteCarlo simulation of a quench from β=0 to β=6
(N=1000, M=500)

Un ménage à trois

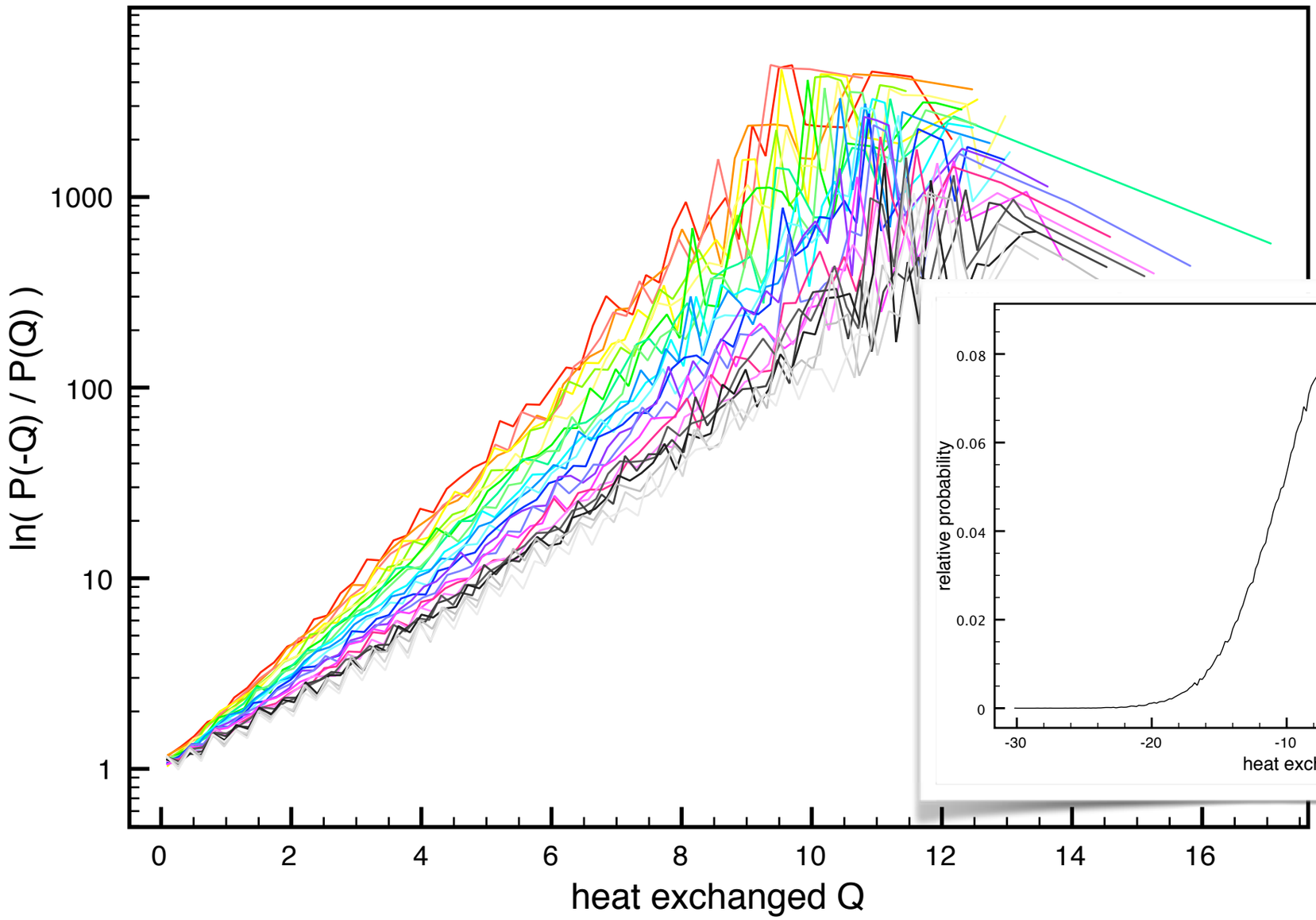




"solid" phase

"liquid" phase

A new (?) fluctuation relation



Heat exchanged by the system between $t=t_w$ and $t=2t_w$ for different values of t_w.