

Informational Analysis of Monte Carlo Simulations of Spin Systems

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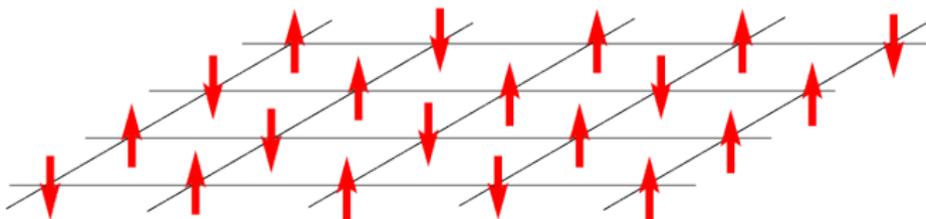
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Ising Model

$$H = -J \sum_{\langle i,j \rangle} S_i S_j$$

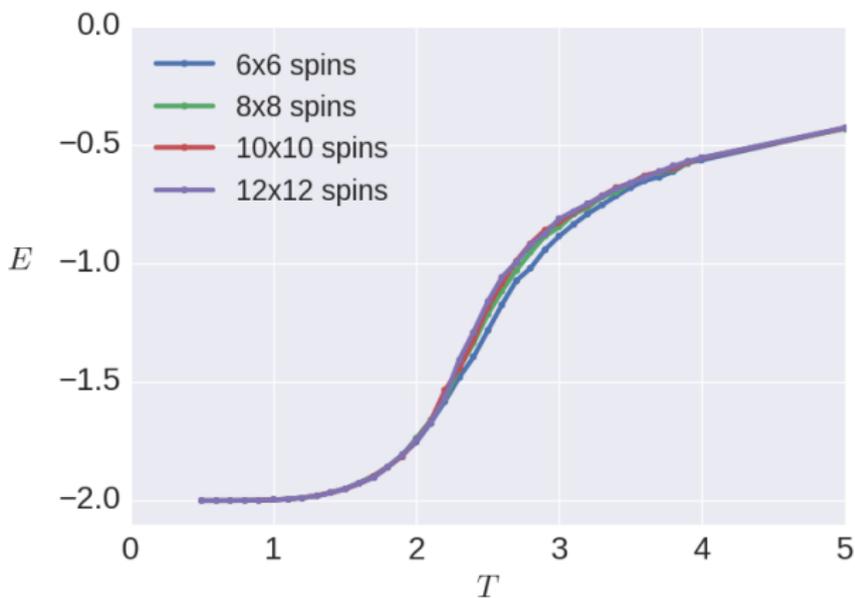


2-D Ising Model

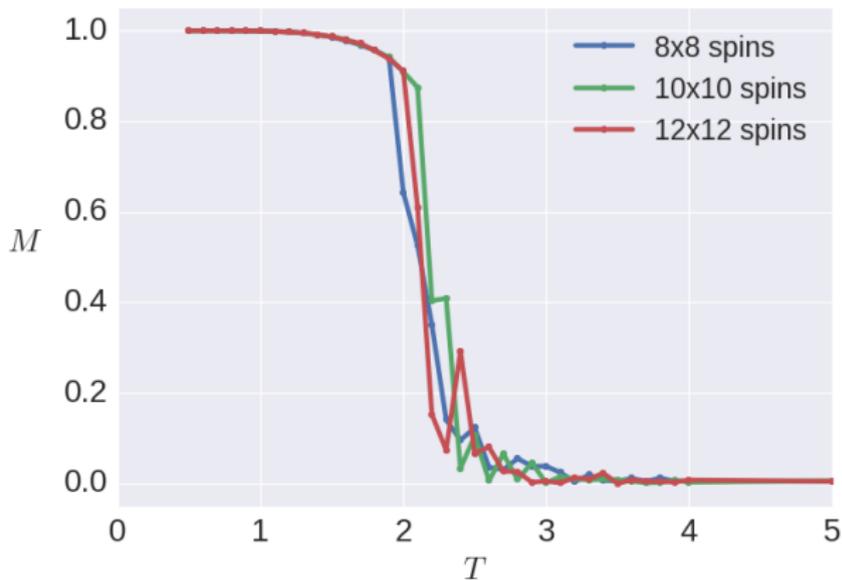
Update algorithm

- Flip random spin
- Find energy change ΔE
- Keep the spin flipped with probability $p = \frac{1}{1 + \exp \frac{\Delta E}{T}}$

Energy vs Temperature

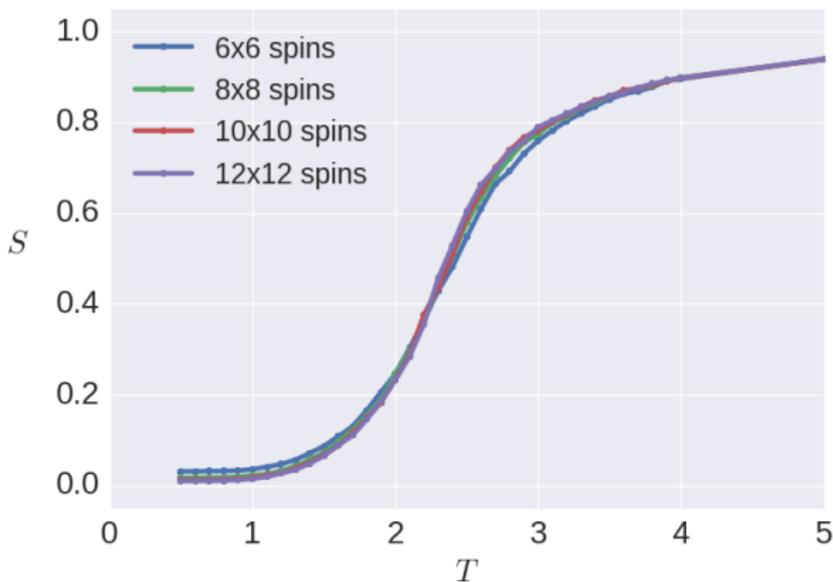


Magnetization vs Temperature

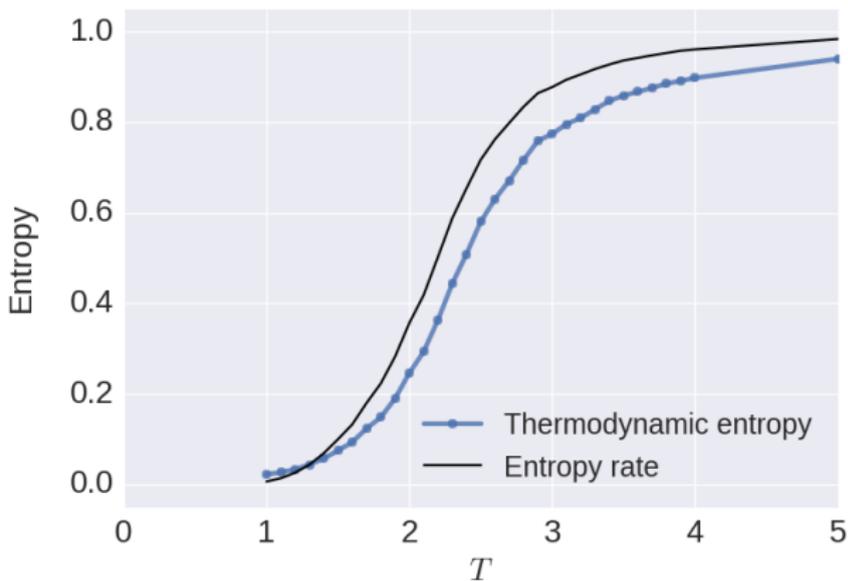


Entropy vs Temperature

$$S(\beta) = E\beta - \int_0^\beta E d\beta$$



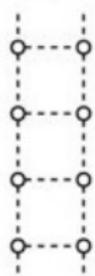
Entropy and Entropy rate



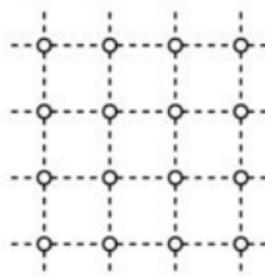
Other lattices



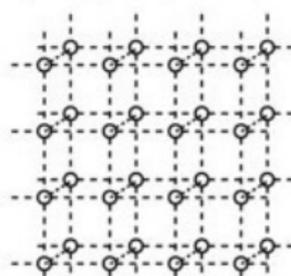
1D



1.5D

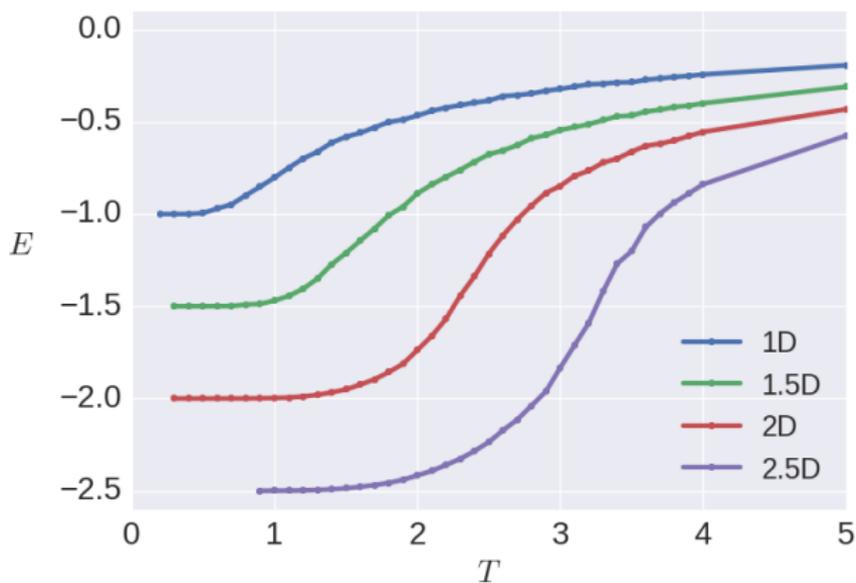


2D

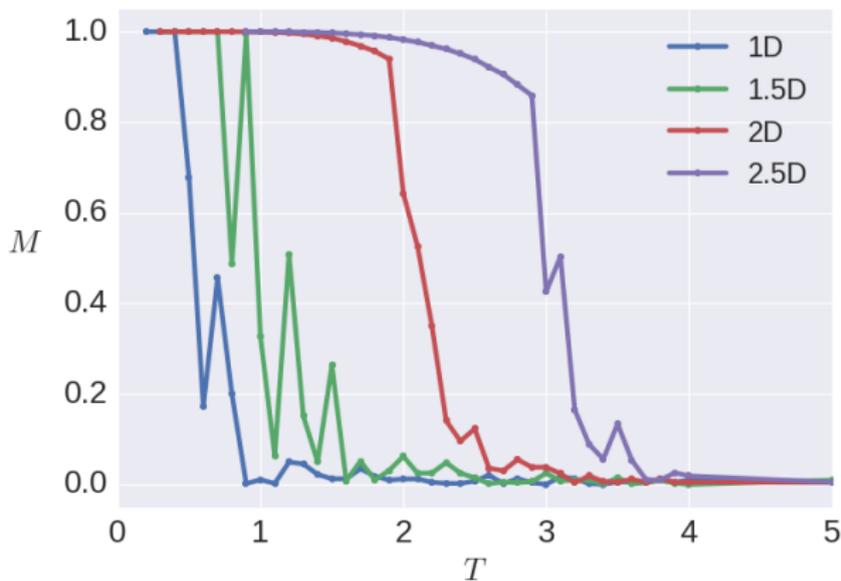


2.5D

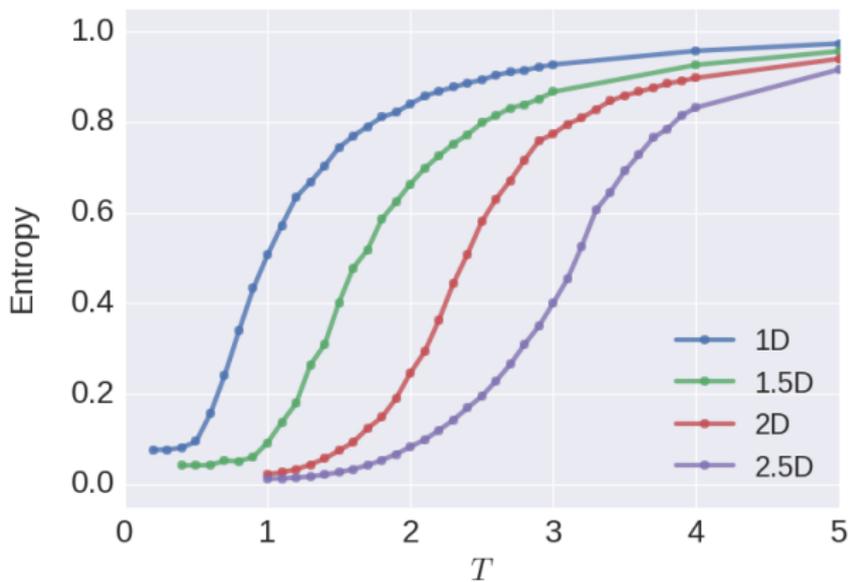
Energies vs Temperature



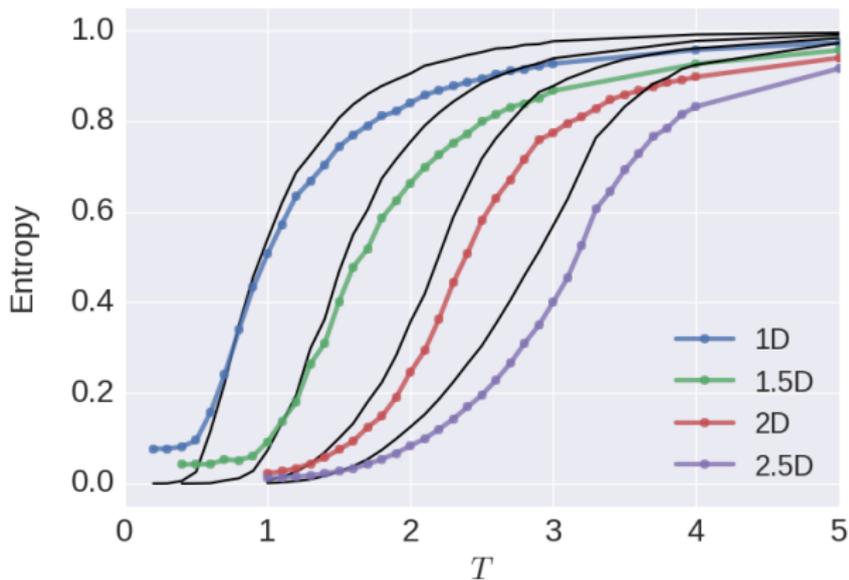
Magnetizations vs Temperature



Entropies vs Temperature

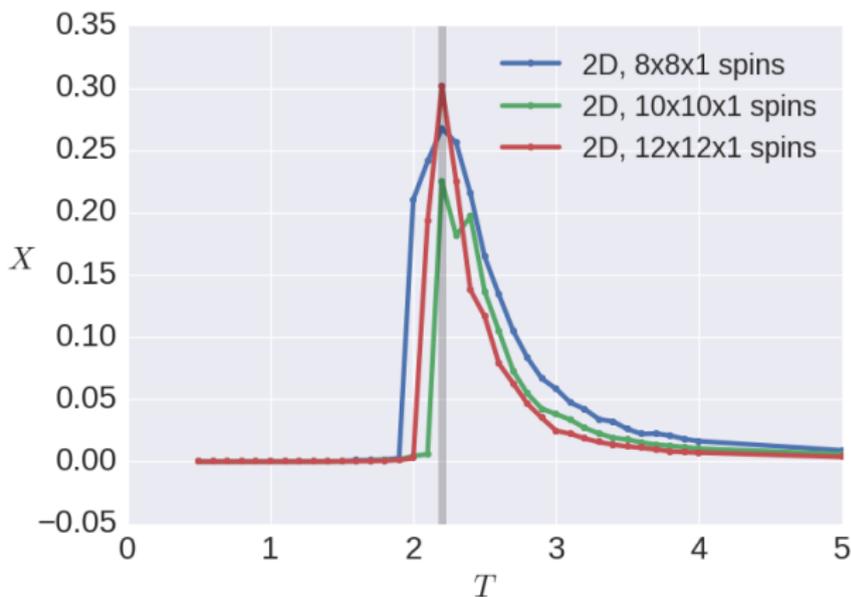


Entropies and Entropy rates

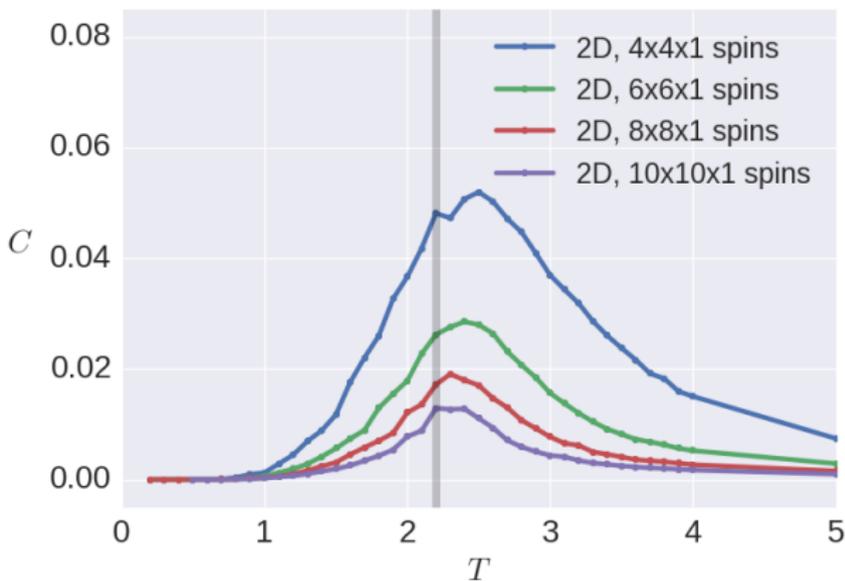


Critical temperature

Magnetic susceptibility diverges at critical temperature

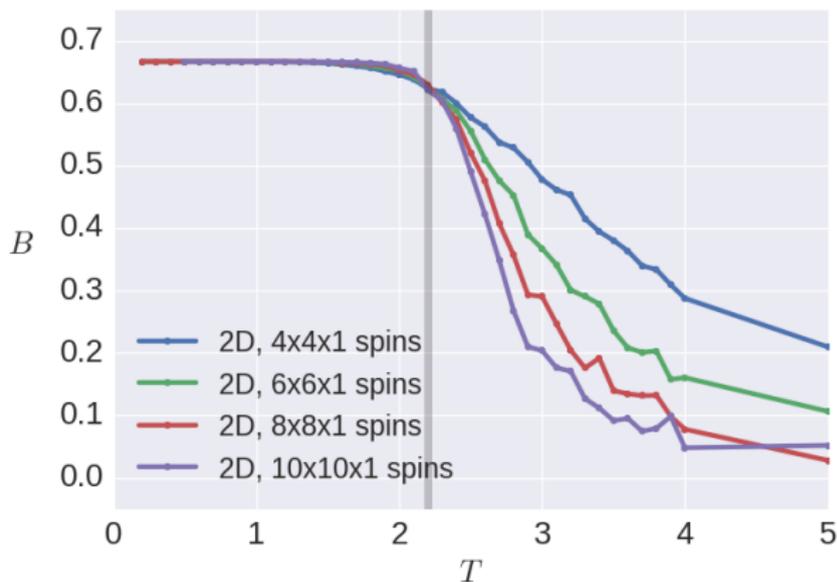


Specific Heat



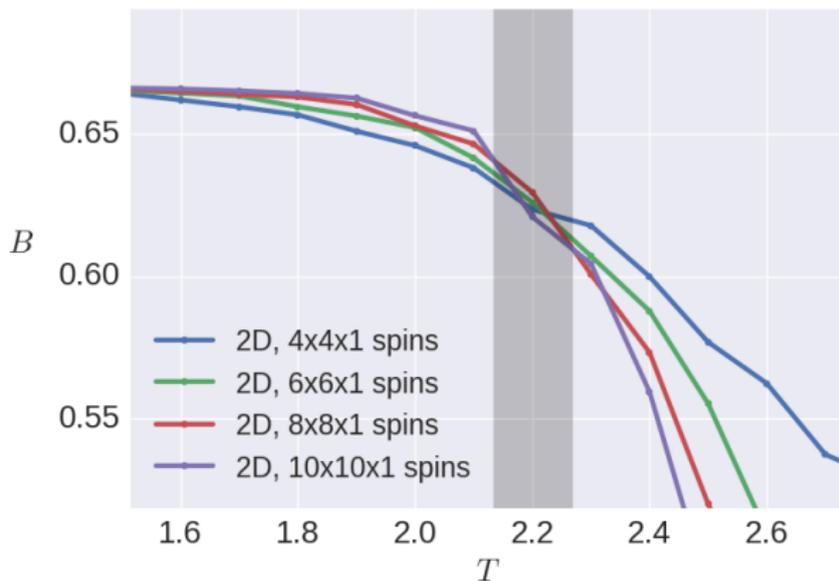
Binder Cumulant

$$B = 1 - \frac{\langle M^4 \rangle}{3\langle M^2 \rangle^2}$$



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Excess Entropy

