Ising Model

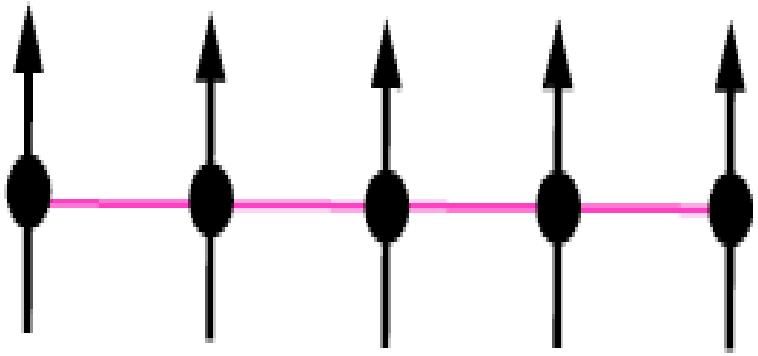
Ising model g model: D=1

Spins are 1D vectors (S=Sz)

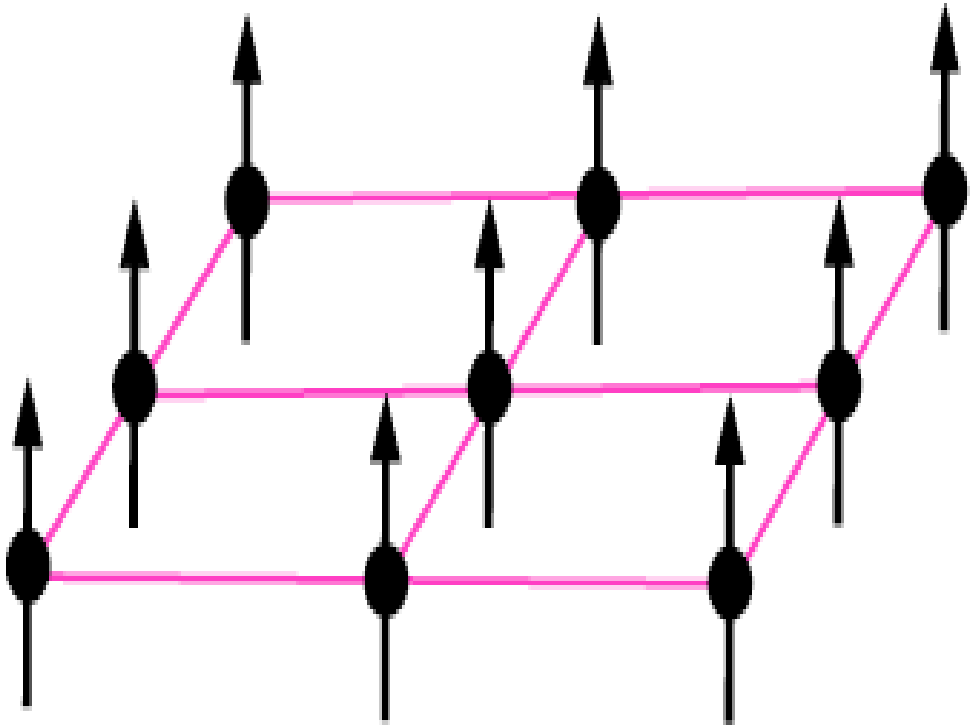
The lattice dimensionality can be d=1,2,3 …

$$\hat{H}_{Ising} = -\sum_{\langle ij \rangle} J S_i^z S_j^z$$

Ising 1D, 1d



Ising 1D, 2d



ISING MODEL

- 1D lattice of N+1 atoms

- All spin ferromagnetically aligned

Ground state energy:

$$E_0 = -NJ/2$$

Energy cost to flip the chain:

$$E = \mathcal{J}$$

+J/2 because is already in favourable state

+J/2 because cost energy in the new state

Entropy gain: S= kB ln N

because we can put the defect in any position

F= E - TS

Free energy:

J kB ln N

For a long chain: N $\rightarrow \infty$, => S $\rightarrow \infty$, F $\rightarrow -\infty$

and as far as T > 0, the long range order is never reached because just the presence of one defect break the long range order in d = 1