Hamiltonian of 2-D Heisenberg model

Bond Hamiltonian:

$$\mathcal{H}_b = -J oldsymbol{s}_0 \cdot oldsymbol{s}_1 + rac{h}{2} s_0^z - rac{h}{2} s_1^z$$

$$\mathcal{H}_b = -Js_0 \cdot s_1 + rac{h}{2} s_0^z - rac{h}{2} s_1^z$$
 External magnetic field
$$= -J \Big[rac{1}{2} (s_0^+ s_1^- + s_0^- s_1^+) + s_0^z s_1^z \Big] + rac{h}{2} s_0^z - rac{h}{2} s_1^z$$



$$\langle 00|\mathcal{H}_b|00\rangle = \langle 11|\mathcal{H}_b|11\rangle = 0,$$

$$\langle 10|\mathcal{H}_b|10\rangle = \frac{J}{4} + \frac{h}{2},$$

$$\langle 01|\mathcal{H}_b|01\rangle = \frac{J}{4} - \frac{h}{2},$$

$$\langle 10|\mathcal{H}_b|01
angle = \langle 01|\mathcal{H}_b|10
angle = -rac{J}{2}.$$
 \uparrow, \downarrow : Spin

