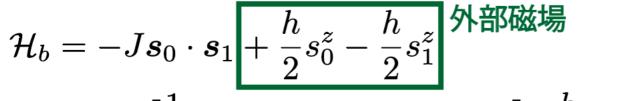
2次元ハイゼンベルグ模型のハミルトニアン

ボンドハミルトニアン:
$$h_z h_z$$
 外部磁場



$$= -Js_0 \cdot s_1 + \frac{1}{2}s_0^2 - \frac{1}{2}s_1^2$$

$$= I^{\left[\frac{1}{2}(s_0^+ s_0^- + s_0^- s_0^+) + s_0^2 s_0^2\right] + h_{s_0^2}}$$

$$= -J\left[\frac{1}{2}(s_0^+s_1^- + s_0^-s_1^+) + s_0^z s_1^z\right] + \frac{h}{2}s_0^z - \frac{h}{2}s_1^z$$

$$-\frac{3}{2}(3031+3031)+$$

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

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

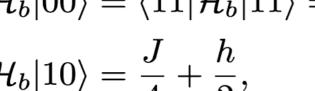
$$\langle 00|\mathcal{H}_b|00\rangle = \langle 11|\mathcal{H}_b|11\rangle = 0,$$

$$\langle 10|\mathcal{H}_b|10\rangle = J h$$

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

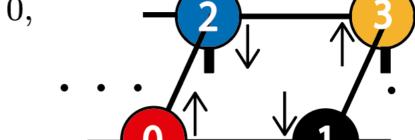
$$\langle 10|\mathcal{H}_b|10
angle = rac{J}{4} + rac{h}{2},$$

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



外部磁場
$$z_1^z$$

$$+s_0^z s_1^z \Big] + \frac{n}{2} s_0^z - \frac{n}{2} s_1^z$$



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

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

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

$$\langle 10|\mathcal{H}_b|01\rangle = \langle 01|\mathcal{H}_b|10\rangle = -\frac{J}{2}$$
. \uparrow, \downarrow :スピン