

Problem 1 (Ex 10.11)

考虑 2 个质量相同的粒子

$$\hat{H} = \frac{\hat{P}_1^2}{2m} + \frac{\hat{P}_2^2}{2m} + V(x_1, x_2)$$

$$\text{其中 } V(x_1, x_2) = \frac{1}{2} m \omega^2 (x_1^2 + x_2^2 + (x_1 - x_2)^2)$$

$$\text{定义 } \hat{x}_{\pm} = \frac{1}{\sqrt{2}} (\hat{x}_1 \pm \hat{x}_2), \quad \hat{p}_{\pm} = \frac{1}{\sqrt{2}} (\hat{p}_1 \pm \hat{p}_2)$$

(1) 证明 $V_+ \otimes V_-$ 可以分解成 $V_+ \otimes V_-$

(2) 求能量的本征值和本征态

Problem 2 (Ex 12.2)

$$(1) \text{ 求 } \hat{L}^2 = \hat{L}_x^2 + \hat{L}_y^2 + \hat{L}_z^2$$

$$(2) \text{ 证明 } [\hat{L}^2, \hat{L}^i] = 0$$