

$$H = \frac{1}{2m} p^2 + \frac{1}{2} m \omega^2 x^2$$

$$x_0 = \sqrt{\frac{\hbar}{m\omega}}$$


$$a = \sqrt{\frac{m\omega}{2\hbar}} \left(x + \frac{i}{m\omega} p \right)$$

$$[a, a^\dagger] = 1$$

$$H = \hbar\omega \left(\frac{a^\dagger a + 1/2}{= \hat{n}} \right)$$

$$n a |n\rangle = (n-1) a |n\rangle$$

$$c^2 = \langle a n | a n \rangle = n \quad a^2 = n+1$$


 $\nabla \nabla |n=0\rangle \Rightarrow n \in \mathbb{N}_0$

$$E_n = \hbar\omega \left(n + \frac{1}{2} \right)$$

$$\psi = N_n \cdot H_n \left(\frac{x}{\sqrt{2} x_0} \right) \cdot e^{-\frac{x^2}{2x_0^2}}$$