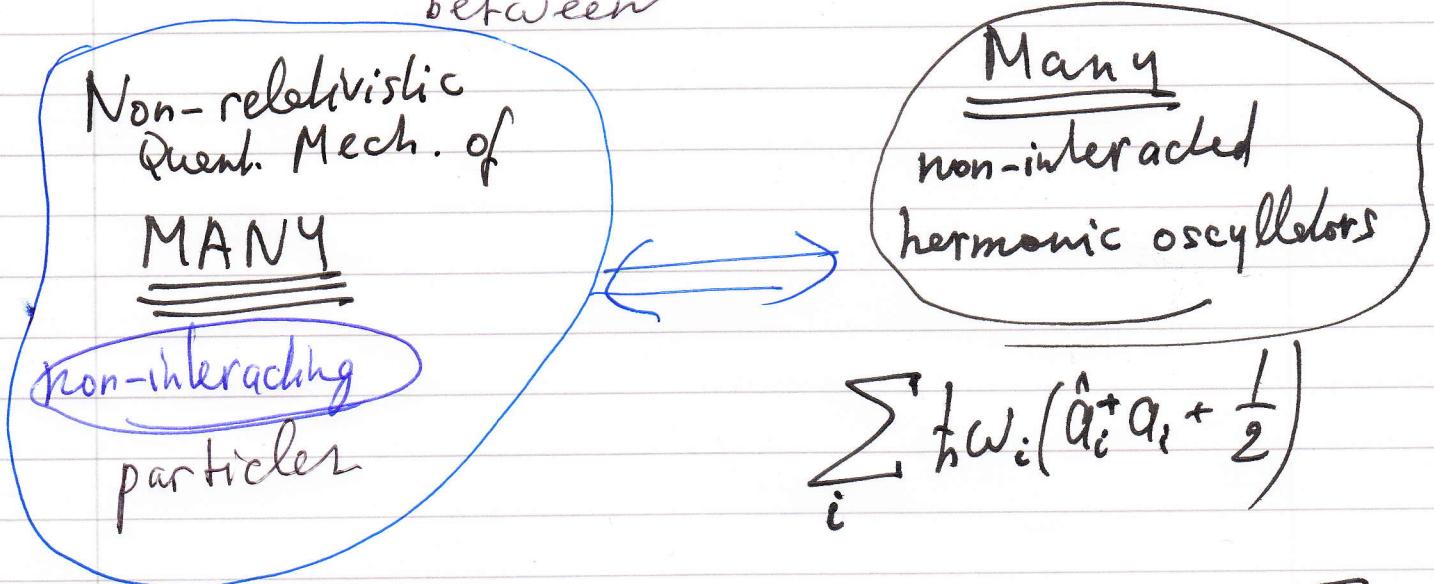


24 IX

Secondary Quantisation.

In previous lecture considering harmonic oscillator we used expressions like 'creation' operator, 'annihilation' operator...
 Today we establish isomorphism between



Let $H = \frac{\hat{p}^2}{2m} + U(q)$ be Hamilt. of particle

classic

$$\hat{H} = \frac{\hat{p}^2}{2m} + U(q) = -\frac{\hbar^2}{2m} \frac{\partial^2}{\partial q^2} + U(q)$$

$$\hat{H} \psi_n = E_n \psi_n \Rightarrow \Psi(x, t) = \sum C_n(t) \psi_n(x),$$

$$\boxed{\frac{dC_n}{dt} = i\hbar E_n C_n} \quad \boxed{i\hbar \frac{\partial \Psi}{\partial t} = \hat{H} \Psi}$$

$(C_n = p_n + i q_n)$

Dif. eq. describing one QUANTUM particle

||

Hamiltonian equation:

$$M = \sum E_n \bar{C}_n C_n, \quad \{C_n, \bar{C}_m\} = i\hbar \delta_{nm}$$

$(C_n, \bar{C}_n \in \mathbb{C})$

$$\dot{C}_n = \{C_n, H\} = i\hbar E_n C_n.$$

$$H = \frac{p^2}{2m} + V(q)$$

$$\hat{H} = \frac{\hat{p}^2}{2m} + U(r) \Leftrightarrow \hat{H} = \sum_n \hat{E}_n \hat{c}_n c_n, \quad \{ , \}$$

Quantisation of H

$$\hat{H} = \sum E_a \hat{a}_n^\dagger \hat{a}_n$$

describes many non-interacting particles

$$\hat{H} = \sum E_n \left(\hat{Q}_n^+ a_n + \frac{1}{2} \right)$$

$K^{\text{th}} \text{ oscillator her Energy}$
 $\hbar\omega_k(h_k + \frac{1}{2})$

\hat{A}_i^+ increases on one number of particles ~~on the~~ with Energy E_i

\hat{Q}_c^+ increases level of

energy of i-th oscillator