

• Per il calcolo dell'eq. 11b) prima notiamo che:

$$[H, a_n^\dagger a_j]^\dagger = (H a_n^\dagger a_j - a_n^\dagger a_j H)^\dagger = a_j^\dagger a_n H - H a_j^\dagger a_n = [a_j^\dagger a_n, H] \\ = -[H, a_j^\dagger a_n] \quad 16$$

Ricorda H è hermitiana.

$$[a_i^\dagger a_m, [H, a_j^\dagger a_n]]^\dagger = -[a_m^\dagger a_i, -[H, a_n^\dagger a_j]] = [a_m^\dagger a_i, [H, a_n^\dagger a_j]] \quad 17$$

Parte sinistra di 11b)

$$\begin{aligned} \langle \Psi_0 | [a_m^\dagger a_i, [H, Q_\nu^\dagger]] | \Psi_0 \rangle &= \\ \sum_{nj} x_{nj}^\nu \langle \Psi_0 | [a_m^\dagger a_i, [H, a_n^\dagger a_j]] | \Psi_0 \rangle &= \\ - \sum_{nj} \gamma_{nj}^\nu \langle \Psi_0 | [a_m^\dagger a_i, [H, a_j^\dagger a_n]] | \Psi_0 \rangle &= \\ = \sum_{nj} x_{nj}^\nu \langle \Psi_0 | [a_i^\dagger a_m, [H, a_j^\dagger a_n]]^\dagger | \Psi_0 \rangle &= \\ - \sum_{nj} \gamma_{nj}^\nu \langle \Psi_0 | [a_i^\dagger a_m, [H, a_n^\dagger a_j]]^\dagger | \Psi_0 \rangle &= \text{per le definizioni} \\ &\text{di eq. 12 (vedi Nota)} \\ = \sum_{nj} x_{nj}^\nu (-B_{minj}^*) + \sum_{nj} \gamma_{nj}^\nu (-A_{minj}^*). \quad 18 \end{aligned}$$

Per la parte destra:

$$\begin{aligned} \langle \Psi_0 | [a_m^\dagger a_i, Q_\nu^\dagger] | \Psi_0 \rangle &= - \sum_{nj} \gamma_{nj}^\nu \langle \Psi_0 | [a_m^\dagger a_i, a_j^\dagger a_n] | \Psi_0 \rangle \\ \rightarrow \text{Quasi Boson App.} \rightarrow - \sum_{nj} \gamma_{nj}^\nu \langle \Phi_0 | [a_m^\dagger a_i, a_j^\dagger a_n] | \Phi_0 \rangle &= \gamma_{nj}^\nu \delta_{jn} \delta_{mi} \end{aligned}$$

Insieme la 11b)

$$\sum_{nj} x_{nj}^\nu (-B_{minj}^*) + \sum_{nj} \gamma_{nj}^\nu (-A_{minj}^*) = (\bar{E}_\nu - \bar{E}_0) \gamma_{mi}^\nu \quad 19$$