

Sistemo anche le due equazioni in forma matriciale

$$\begin{pmatrix} A & B \\ B^* & A^* \end{pmatrix} \begin{pmatrix} x^p \\ y^p \end{pmatrix} = (\bar{E}_p - E_0) \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} x^p \\ y^p \end{pmatrix} = (\bar{E}_p - E_0) \begin{pmatrix} x^p \\ -y^p \end{pmatrix} \quad 20$$

- Adesso bisogna calcolare gli elementi di matrice A e B, che devono essere valutati dopo la Quasi-Boson Approx.

$$A_{mijn} \rightarrow \langle \bar{\Phi}_0 | [a_i^\dagger a_m, [H, a_n^\dagger a_j]] | \bar{\Phi}_0 \rangle = \text{elemento TDA} = (\epsilon_m - \epsilon_i) \delta_{mn} \delta_{ij} + \bar{V}_{mjin} \quad 21$$

Calcolo di B

$$B_{mijn} \rightarrow - \langle \bar{\Phi}_0 | [a_i^\dagger a_m, [H, a_j^\dagger a_n]] | \bar{\Phi}_0 \rangle \quad 22$$

$$H = \sum_{\alpha\beta} h_{\alpha\beta} a_\alpha^\dagger a_\beta - \frac{1}{2} \sum_{ij} \bar{V}_{ijij} + \frac{1}{4} \sum_{\alpha\beta\gamma\beta'} \bar{V}_{\alpha\beta\gamma\beta'} N [a_\alpha^\dagger a_\beta^\dagger a_{\beta'} a_{\gamma'}] \quad 23$$

Consideriamo il commutatore del termine a un corpo (che e' zero).

$$\begin{aligned} [a_\alpha^\dagger a_\beta, a_j^\dagger a_n] &= a_\alpha^\dagger a_\beta a_j^\dagger a_n - a_j^\dagger a_n a_\alpha^\dagger a_\beta = \\ &= a_\alpha^\dagger [\delta_{\beta j} - a_j^\dagger a_\beta] a_n - a_j^\dagger [\delta_{na} - a_\alpha^\dagger a_n] a_\beta = \\ &= \delta_{\beta j} a_\alpha^\dagger a_n - \cancel{a_\alpha^\dagger a_j^\dagger a_\beta a_n} - \delta_{na} a_j^\dagger a_\beta + \cancel{a_j^\dagger a_\alpha^\dagger a_n a_\beta} \end{aligned} \quad 24$$

$$\begin{aligned} \langle \bar{\Phi}_0 | [a_i^\dagger a_m, [a_\alpha^\dagger a_\beta, a_j^\dagger a_n]] | \bar{\Phi}_0 \rangle &= \\ \langle \bar{\Phi}_0 | [a_i^\dagger a_m, a_\alpha^\dagger a_n] | \bar{\Phi}_0 \rangle \delta_{\beta j} - \langle \bar{\Phi}_0 | [a_i^\dagger a_m, a_j^\dagger a_\beta] | \bar{\Phi}_0 \rangle \delta_{na} &= \\ = \langle \bar{\Phi}_0 | a_i^\dagger a_m a_\alpha^\dagger a_n | \bar{\Phi}_0 \rangle - \langle \bar{\Phi}_0 | a_\alpha^\dagger a_n a_i^\dagger a_m | \bar{\Phi}_0 \rangle - \langle \bar{\Phi}_0 | a_i^\dagger a_m a_j^\dagger a_\beta | \bar{\Phi}_0 \rangle + \langle \bar{\Phi}_0 | a_j^\dagger a_\beta a_i^\dagger a_m | \bar{\Phi}_0 \rangle \\ \downarrow \qquad \qquad \qquad \downarrow \qquad \qquad \qquad \delta_{j\beta} \delta_{im} \qquad \qquad \qquad \downarrow \end{aligned} \quad 25$$