Lecture 3: Introduction into second quantization.

Motivation of a large Hilbert space $H_0 \bigoplus H_1 \bigoplus ...$

$\{\alpha_1 ... \alpha_N \rangle = a^\dagger_{\alpha_1} ... a^\dagger_{\alpha_N} |0\rangle \quad (F)$

$\{\alpha_1 ... \alpha_N \rangle = \prod_\lambda \frac{1}{\sqrt{n_\lambda}} a^\dagger_{\alpha_1} ... a^\dagger_{\alpha_N} |0\rangle \quad (B)$

$a^\dagger_\alpha \{\alpha_1 ... \alpha_N \rangle = \{\alpha\alpha_1 ... \alpha_N \rangle \ (F)$

if $\{\alpha_1 ... \alpha_N \rangle_U \equiv a^\dagger_{\alpha_1} ... a^\dagger_{\alpha_N} |0\rangle \ (B)$

$a^\dagger_\alpha \{\alpha_1 ... \alpha_N \rangle_U = \sqrt{n_\lambda + 1} \ \{\alpha\alpha_1 ... \alpha_N \rangle_U \quad (B)$

$\{\alpha_1 ... \alpha_N \rangle = \sum_p \frac{signP}{\sqrt{N!}} P |\alpha_1\rangle ... |\alpha_N\rangle \quad (F)$

$\{\alpha_1 ... \alpha_N \rangle = \sum_p \frac{1}{\sqrt{N!}} P |\alpha_1\rangle ... |\alpha_N\rangle \quad (B)$

changes of basis $Q^\dagger_\beta = \sum_\alpha a^\dagger_\alpha \langle\alpha|\beta\rangle$

Lecture 4: matrix elements of one and two body.

$T = \sum_{\alpha\beta} \langle\alpha|T|\beta\rangle \, a^\dagger_\alpha a_\beta; \ \ T = \sum_i T(i)$

$V = \frac{1}{2} \sum_{\alpha\beta\gamma\delta} \langle\alpha\beta|T|\gamma\delta\rangle \, a^\dagger_\alpha a^\dagger_\beta a_\delta a_\gamma; \ \ V = \sum_{i<j} T(ij)$