2nde quantification : Dictionnaire

P. Coleman *Introduction to Many-Body Physics* (Ch. 3)

	First Quantization	Second Quantization
Wavefn $\longrightarrow$ Field Operator	$\psi(x) = \langle x\|\psi\rangle$	$\hat{\psi}(x)$
Commutator	$[x, p] = i\hbar$	$[\hat{\psi}(x), \hat{\psi}^\dagger(x')]_\mp = \delta^D(x - x')$
Density	$\rho(x) = \|\psi(x)\|^2$	$\hat{\rho}(x) = \hat{\psi}^\dagger(x)\hat{\psi}(x)$
Arbitrary Basis	$\psi_\lambda = \langle\lambda\|\psi\rangle$	$\hat{\psi}_\lambda$
Change of Basis	$\langle\tilde{s}\|\psi\rangle = \sum_\lambda \langle\tilde{s}\|\lambda\rangle\langle\lambda\|\psi\rangle$	$\hat{a}_s = \sum_\lambda \langle\tilde{s}\|\lambda\rangle\hat{\psi}_\lambda$
Orthogonality	$\langle\lambda\|\lambda'\rangle = \delta_{\lambda\lambda'}$	$[\psi_\lambda, {\psi^\dagger}_{\lambda'}]_\mp = \delta_{\lambda\lambda'}$
One ptcle Energy	$\frac{p^2}{2m} + U$	$\int_x \hat{\psi}^\dagger(x)\left(-\frac{\hbar^2}{2m}\nabla^2 + U(x)\right)\hat{\psi}(x)$
Interaction	$\sum_{i<j} V(x_i - x_j)$	$\hat{V} = \frac{1}{2}\int_{x,x'} V(x - x') : \hat{\rho}(x)\hat{\rho}(x') :$ $= \frac{1}{2}\sum V(\mathbf{q}) {c^\dagger}_{\mathbf{k}+\mathbf{q}} {c^\dagger}_{\mathbf{k}'-\mathbf{q}} c_{\mathbf{k}'} c_{\mathbf{k}}$
Many Body Wavefunction	$\Psi(x_1, x_2 \ldots x_N)$	$\langle 0\|\hat{\psi}(x_1)\ldots\hat{\psi}(x_N)\|\Psi>$
Schrödinger Eqn	$\left(\sum \mathcal{H}_i + \sum_{i<j} V_{ij}\right)\Psi = i\hbar\dot{\Psi}$	$[\mathcal{H}^{(0)} + \int_{x'} \hat{\rho}(x')V(x' - x)]\hat{\psi}(x) = i\hbar\dot{\psi}(x)$