

## 2.3 Feldoperatoren

---

$$\hat{N} = \sum_{\lambda=1}^{\infty} a_{\lambda}^{\dagger} a_{\lambda} = \sum_{\lambda=1}^{\infty} \int \psi_{\lambda}(\underline{x}) \hat{\psi}^{\dagger}(\underline{x}) d\tau \int \psi_{\lambda}^*(\underline{x}') \hat{\psi}(\underline{x}') d\tau'$$

$$= \int \underbrace{\sum_{\lambda=1}^{\infty} \psi_{\lambda}(\underline{x}) \psi_{\lambda}^*(\underline{x}')}_{= \delta(\underline{x} - \underline{x}')} \hat{\psi}^{\dagger}(\underline{x}) \hat{\psi}(\underline{x}') d\tau d\tau'$$

$$= \int \hat{\psi}^{\dagger}(\underline{x}) \hat{\psi}(\underline{x}) d\tau \quad \phi(\underline{r}) = \begin{pmatrix} \phi_{\frac{1}{2}}(\underline{r}) \\ \phi_{\frac{3}{2}}(\underline{r}) \end{pmatrix}$$

$$\begin{pmatrix} \phi_{\frac{1}{2}}(\underline{r}) \\ \phi_{\frac{3}{2}}(\underline{r}) \end{pmatrix} = \begin{pmatrix} h_{\frac{1}{2}\frac{1}{2}} & h_{\frac{1}{2}\frac{3}{2}} \\ h_{\frac{3}{2}\frac{1}{2}} & h_{\frac{3}{2}\frac{3}{2}} \end{pmatrix} \begin{pmatrix} \psi_{\frac{1}{2}}(\underline{r}) \\ \psi_{\frac{3}{2}}(\underline{r}) \end{pmatrix}$$