

6.4 Quantenfeldtheorie $\psi_\nu(\vec{r}, t), \nu=1, 2, \dots, n$

Variationsprinzip $\delta \int_{t_1}^{t_2} dt \int d^3r \mathcal{L}(\psi_\nu, \psi_{\nu k}, \dot{\psi}_\nu, t) = 0$

\mathcal{L} muss so gefunden werden, dass aus der Variation die Feldgleichungen der $\psi_\nu(\vec{r}, t)$ folgen.

Nebenbedingungen: $\delta \psi_\nu(\vec{r}, t_1) = 0 = \delta \psi_\nu(\vec{r}, t_2)$; $\delta t = 0$
 $\psi_\nu(\vec{r}, t) \xrightarrow{|\vec{r}| \rightarrow \infty} 0, \delta \psi_\nu(\vec{r}, t) \xrightarrow{|\vec{r}| \rightarrow \infty} 0$

$$0 = \int_{t_1}^{t_2} dt \int d^3r \sum_{\nu=1}^n \left[\frac{\partial \mathcal{L}}{\partial \psi_\nu} \delta \psi_\nu + \frac{\partial \mathcal{L}}{\partial \psi_{\nu k}} \delta \psi_{\nu k} + \frac{\partial \mathcal{L}}{\partial \dot{\psi}_\nu} \delta \dot{\psi}_\nu + \frac{\partial \mathcal{L}}{\partial t} \delta t \right]$$

$$\dots \left[\frac{\partial \mathcal{L}}{\partial \psi_\nu} \delta \psi_\nu - \sum_{k=1}^3 \frac{\partial}{\partial x_k} \frac{\partial \mathcal{L}}{\partial \psi_{\nu k}} \delta \psi_\nu - \frac{\partial}{\partial t} \frac{\partial \mathcal{L}}{\partial \dot{\psi}_\nu} \delta \psi_\nu \right]$$

$$\frac{\delta H}{\delta \psi_\nu} = - \frac{\delta \mathcal{L}}{\delta \psi_\nu} = - \frac{\partial \mathcal{L}}{\partial \psi_\nu} + \sum_{k=1}^{\infty} \frac{\partial}{\partial x_k} \frac{\partial \mathcal{L}}{\partial \psi_{\nu k}} = - \frac{\partial \mathcal{L}}{\partial t \partial \dot{\psi}_\nu} = - \dot{\pi}_\nu$$

$$+ \frac{\partial}{\partial x_1} \frac{\partial A_1}{\partial x_1}$$

$$c |n\rangle = \sqrt{n} |n-1\rangle$$

$$c^\dagger |n\rangle = \sqrt{n+1} |n+1\rangle$$

$$\langle n | \hat{E} | n \rangle = ?$$