6.4 Quantenfeldtheorie

$\psi_\nu(\vec r, t)$, $\nu = 1, 2 \dots n$

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

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

Nebenbedingungen: $\delta\psi_\nu(\vec r, t_1) = 0 = \delta\psi_\nu(\vec r, t_2)$; $\delta t = 0$

$$\psi(\vec r, t) \xrightarrow[|\vec r| \to \infty]{} 0 \, , \; \delta\psi_\nu(\vec r, t) \xrightarrow[|\vec r| \to \infty]{} 0$$

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

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

$$\frac{\delta H}{\delta\psi_\nu} = -\frac{\delta L}{\delta\psi_\nu} = -\frac{\partial\mathcal{L}}{\partial\psi_\nu} + \sum_{k=1}^{\infty} \frac{\partial}{\partial x_k}\frac{\partial\mathcal{L}}{\partial\psi_{\nu|k}} = -\frac{\partial\mathcal{L}}{\partial t\,\partial\dot\psi_\nu} = -\dot\pi_\nu$$

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

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

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

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