Bewegungsgln.: $m\ddot{x} = -\nabla V(x)$

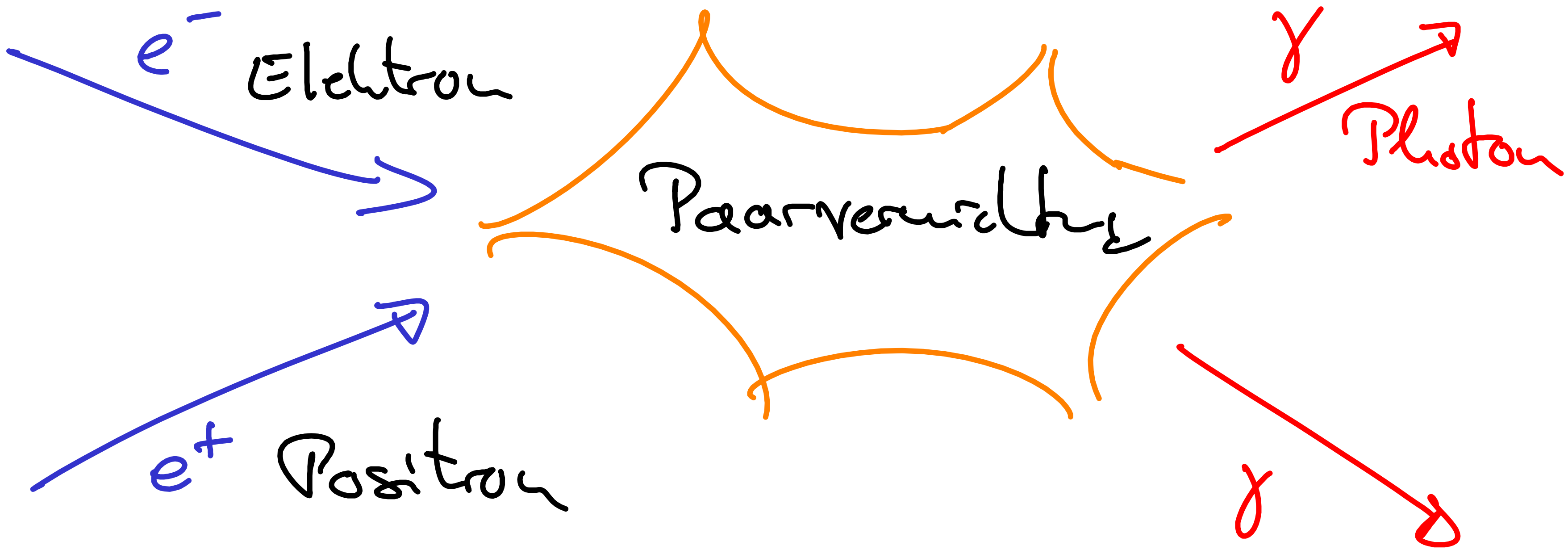
Kommutator: $[A,B] = AB - BA$

Hamiltonfkt.: $H(p,x) = \frac{p^2}{2m} + V(x)$

"quantisieren"

$p^2 = -\hbar^2 \Delta$

Hamiltonop.: $\hat{H} = -\frac{\hbar^2}{2m}\Delta + V(x)$



e⁻ Elektron
e⁺ Positron
Paarvernichtung
γ Photon
γ

- $$\left(a^\dagger(\psi)\,\Phi\right)_0 = 0$$

- $$\left(a^\dagger(\psi)\,\Omega\right)_1(x_1) = \frac{1}{\sqrt{1}}\sum_{j=1}^{1}\psi(x_j)\cdot 1 = \psi(x_1)$$

alle anderen Null

- $$\left(a(\psi)\,(0,\psi,0,\dots)\right)_0 = \sqrt{1}\int \overline{\psi}(x)\,\psi(x)\,d^3x$$
$$= \|\psi\|^2 \qquad (=\alpha)$$

- $$\left(a^\dagger(\psi)\,(0,\phi,0,\dots)\right)_2(x_1,x_2) = \frac{1}{\sqrt{2}}\left(\psi(x_1)\,\phi(x_2) + \psi(x_2)\,\phi(x_1)\right)$$

$$\Big(\big(\underbrace{\sum_j a^+(\varphi_j)\,\overline{\varphi_j}(x)}_{\text{"}=a^+(x)\text{"}}\big)\,\Omega\Big)_1(x_1)$$

$$= \sum_j \underbrace{\big(a^+(\varphi_j)\,\Omega\big)_1(x_1)}_{=\varphi_j(x_1)}\,\overline{\varphi_j}(x)$$

$$= \delta(x - x_1)$$

$$a(x) = \sum_j a(\varphi_j)\,\varphi_j(x)$$

$$\sum_j \psi_j(x)\,\overline{\psi}(x') = \delta(x-x')$$ warum?

Vollständigkeit

Integralkern für Fourierentwicklung in $\{\psi_j\}$

$$\phi \in L^2(\mathbb{R}^3)$$

$$\phi(x) = \sum_j c_j \psi_j(x)$$

$$c_j = \langle \psi_j , \phi \rangle = \int_{\mathbb{R}^3} \overline{\psi_j}(x')\,\phi(x')\, d^3x'$$

$$= \int_{\mathbb{R}^3} \underbrace{\sum_j \psi_j(x)\,\overline{\psi_j}(x')}_{\text{Integralkern d. Entwicklung}} \phi(x')\, d^3x'$$

$$a(x) = \sum_j a(\psi_j)\, \psi_j(x)$$

$$\int_{\mathbb{R}^3} \overline{\psi}(x)\, a(x)\, d^3x = \sum_j \langle \psi, \psi_j \rangle\, a(\psi_j)$$

$$= a\left(\sum_j \langle \psi_j, \psi \rangle\, \psi_j \right) = a(\psi)$$