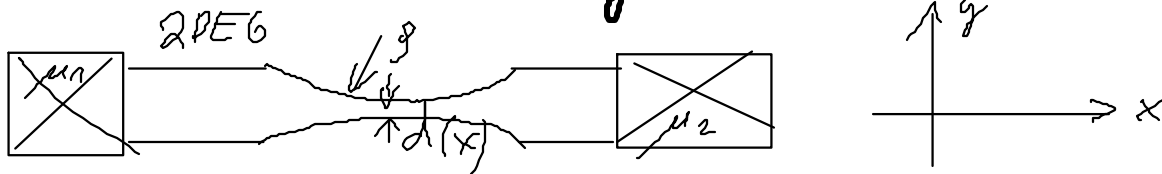


2.6 Adiabatische Einschränkung



$$\frac{d}{\rho} \ll 1 \quad \left[-\frac{\hbar^2}{2m} \left(\frac{d^2}{dx^2} + \frac{d^2}{dy^2} \right) + U(x,y) \right] \psi_E(x,y) = E \psi_E$$

Ausatz: $\psi_E(x,y) = \sum_n \psi_{nE}(x) \chi_n(y|x)$ ↑ parametrisiert

mit $\left(-\frac{\hbar^2}{2m} \frac{d^2}{dy^2} + U(x,y) \right) \chi_n(y|x) = U_n(x) \chi_n(y|x)$

Einsetzen:

$$\sum_n \left[-\frac{\hbar^2}{2m} \frac{d^2}{dx^2} + U_n(x) \right] \psi_{nE}(x) \chi_n(y|x) = E \sum_n \psi_{nE}(x) \chi_n(y|x)$$

$$\sum_n \chi_n(y|x) \left(-\frac{\hbar^2}{2m} \frac{d^2}{dx^2} + U_n(x) \right) \psi_{nE}(x)$$

$$- \frac{\hbar^2}{2m} \frac{d}{dx} \psi_{nE}(x) \frac{d}{dx} \chi_n(y|x)$$

$$- \frac{\hbar^2}{2m} \psi_{nE}(x) \frac{d^2}{dx^2} \chi_n(y|x)$$

$$= E \sum_n \dots$$

$$\int dy \chi_n^*(y|x) \dots$$

$$\left[-\frac{\hbar^2}{2m} \frac{d^2}{dx^2} + U_n(x) - E \right] \psi_{nE}(x) = \sum_{n' \neq n} \lambda_{nn'} \psi_{n'E}(x)$$

$$\lambda_{nn'} = \frac{\hbar^2}{2m} \int dy \left[\chi_n^*(y|x) \frac{1}{2} \frac{d^2}{dx^2} \chi_{n'}(y|x) + \chi_n^*(y|x) \frac{d}{dx} \chi_{n'}(y|x) \frac{d}{dx} \right]$$

adiabatische $\lambda_{nn'}$ vernachlässigbar

Beispiel

$$U(x,y) = \begin{cases} 0 & |y| \leq \frac{d(x)}{2} \\ \infty & \text{sonst} \end{cases}$$

$$\chi_n(y|x) \propto \sin\left(n\pi \frac{y + \frac{d(x)}{2}}{d(x)}\right)$$

$$U_n(x) = \frac{\hbar^2}{2m} \left(\frac{n\pi}{d(x)} \right)^2 \quad (n=1, 2, 3, \dots)$$

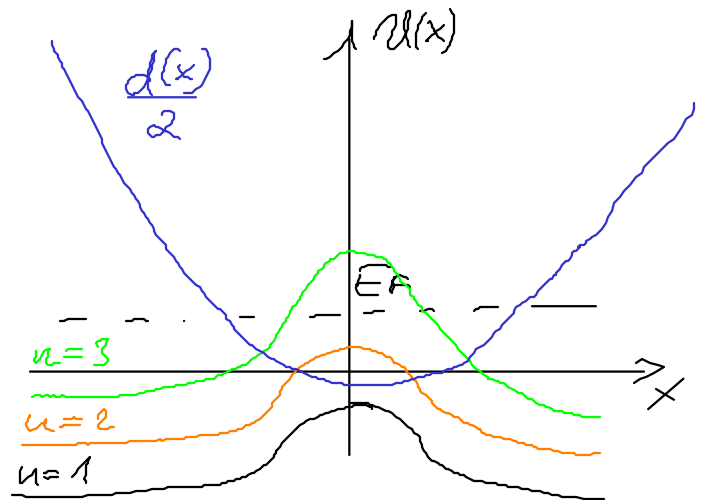
$$G = \frac{2e^2}{\hbar} \sum_n T_n$$

• Kanäle mit:

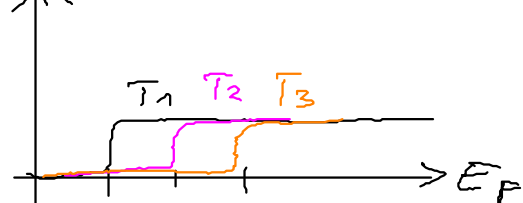
$$U_n(0) \ll E_F \quad \text{keiner Kanal } T_n = 1$$

$$U_n(0) \approx E_F \quad 0 \leq T_n \leq 1$$

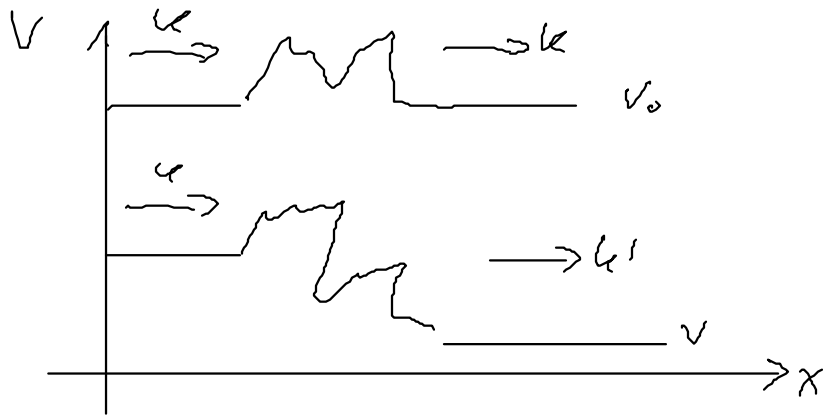
$$U_n(0) \gg E_F \quad T_n = 0$$



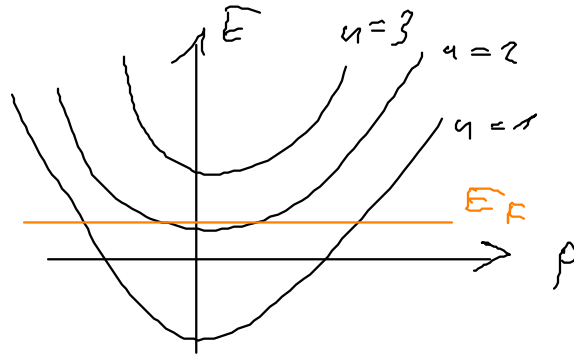
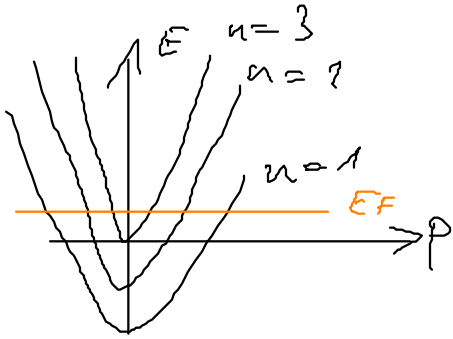
T (Transmission)



Ergänzung zur S-Matrix



$$E_{k'} = E_v + \frac{\hbar^2 k^2}{2m}$$



Eine S-Matrix auf der anderen nicht!