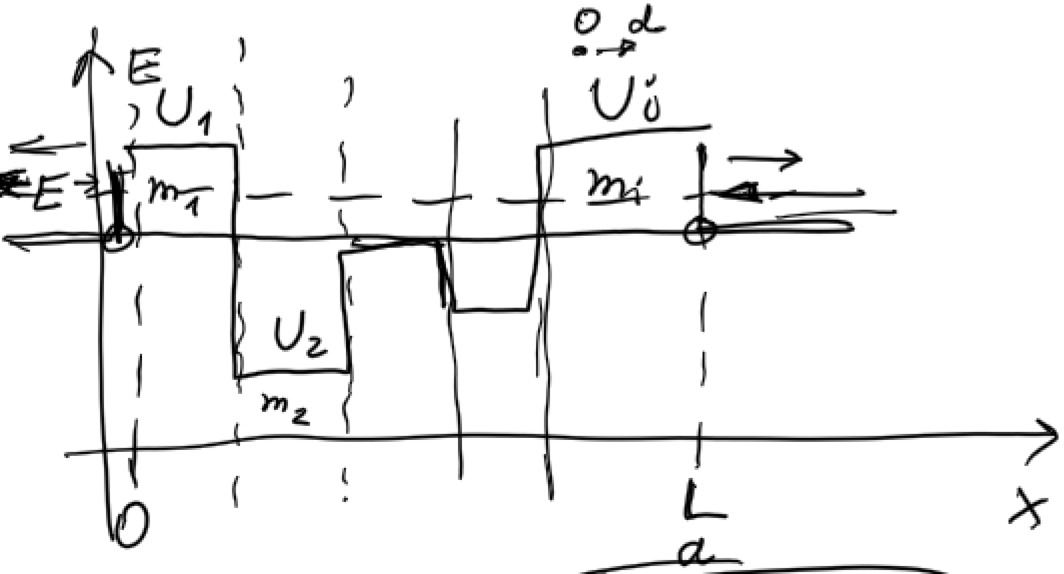


$$\Psi^{(i)} = A_i^+ e^{ik_i x} + A_i^- e^{-ik_i x}$$

$$|\psi\rangle_i = \begin{pmatrix} A_i^+ \\ A_i^- \end{pmatrix}$$

$$\begin{pmatrix} A_i^+(d) \\ A_i^-(d) \end{pmatrix} = \begin{pmatrix} e^{ik_i d} & 0 \\ 0 & e^{-ik_i d} \end{pmatrix} \begin{pmatrix} A_i^+(0) \\ A_i^-(0) \end{pmatrix}$$

$$\boxed{\begin{aligned} v_1 &= v_2 \\ \frac{k_1}{m_1} &= \frac{k_2}{m_2} \end{aligned}}$$

$$\frac{\Psi_1'}{m_1} = \frac{\Psi_2'}{m_2}$$

$$\begin{pmatrix} A_2^+ \\ A_2^- \end{pmatrix} = T_{21}(E) \begin{pmatrix} A_1^+ \\ A_1^- \end{pmatrix}$$

$$\boxed{T_{21}(E) = F_2^{-1} F_1}$$

$$\psi, \quad \frac{\psi'}{m} \sim \pm\frac{k}{m}$$

$$k_{1,2} = \sqrt{2m_{1,2}(E - V_{1,2})}$$

$$\begin{pmatrix} \psi_i \\ \frac{\psi_i'}{m} \end{pmatrix} \sim \begin{pmatrix} 1 & 1 \\ \frac{k_i}{m} & -\frac{k_i}{m} \end{pmatrix} \begin{pmatrix} A_i^+ \\ A_i^- \end{pmatrix}$$

$$x = 0$$

$$\psi_i = A_i^+ + A_i^-$$

$$\frac{\psi_i'}{m} \sim \frac{k_i}{m_i} A_i^+ - \frac{k_i}{m_i} A_i^-$$

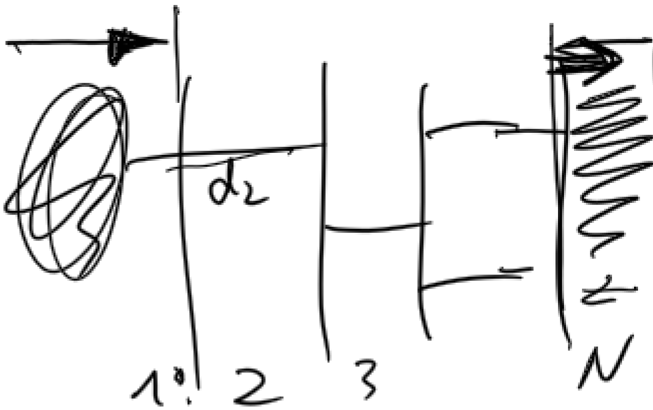
$$F_i \equiv \begin{pmatrix} 1 & 1 \\ \frac{k_i}{m_i} & -\frac{k_i}{m_i} \end{pmatrix}$$

$$\boxed{\begin{pmatrix} A_2^+ \\ A_2^- \end{pmatrix} = F_2^{-1} F_1 \begin{pmatrix} A_1^+ \\ A_1^- \end{pmatrix}}$$

$$\begin{pmatrix} \psi_i \\ \frac{\psi_i'}{m} \end{pmatrix} \sim F_i \begin{pmatrix} A_i^+ \\ A_i^- \end{pmatrix}$$

$$F_2^{-1} *$$

$$F_2 \begin{pmatrix} A_2^+ \\ A_2^- \end{pmatrix} = \begin{pmatrix} \psi_2 \\ \frac{\psi_2'}{m_2} \end{pmatrix} = \begin{pmatrix} \psi_1 \\ \frac{\psi_1'}{m_1} \end{pmatrix} = F_1 \begin{pmatrix} A_1^+ \\ A_1^- \end{pmatrix}$$



$$T_{21} = \frac{1}{2}\begin{pmatrix} 1+M & 1-M \\ 1-M & 1+M \end{pmatrix}$$

$$M = \frac{m_2^* k_1(E)}{m_1^* k_2(E)}$$

$$T_{N\,N-1} \; T_{3,d_3} \; T_{32} \; T_{2,d_2} \; T_{21} \begin{pmatrix}A_1^+\\A_1^-\end{pmatrix} = \begin{pmatrix}A_N^+\\A_N^-\end{pmatrix}$$

$$\begin{pmatrix}A_N^+\\A_N^-\end{pmatrix} = T_{tot}\begin{pmatrix}A_1^+\\A_1^-\end{pmatrix} \qquad \begin{pmatrix}t\\0\end{pmatrix} = T_{tot}\begin{pmatrix}1\\r\end{pmatrix}$$

$$\begin{pmatrix}A_N^+\\A_N^-\end{pmatrix} = \begin{pmatrix}t\\0\end{pmatrix}$$

A_1^+

A_1^-

$|A_N^+|^2 = T$

$|A_1^+|^2 = 1$

$|A_1^-|^2 = R$

$|t|^2 = T$

$|r|^2 = R$

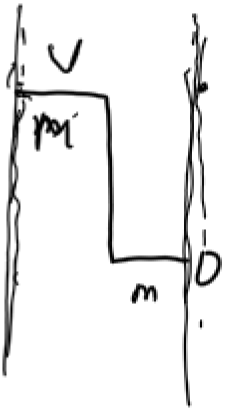
$$\begin{pmatrix} t \\ 0 \end{pmatrix} = \begin{pmatrix} T_{11}(E) & T_{12}(E) \\ T_{21}(E) & T_{22}(E) \end{pmatrix} \begin{pmatrix} 1 \\ r \end{pmatrix}$$

$$0 = T_{21} + T_{22} \cdot r$$

$$r = -\frac{T_{21}}{T_{22}}$$

$$t = T_{11} + T_{12}\left(-\frac{T_{21}}{T_{22}}\right)$$

$$\boxed{t = \frac{\det T}{T_{22}}}$$



$$\Psi(x+d) = e^{ikd}\,\Psi(x)$$

$$\hat{T}_d \begin{pmatrix}A^+\\A^-\end{pmatrix} = e^{ikd}\begin{pmatrix}1&0\\0&1\end{pmatrix}\begin{pmatrix}A^+\\A^-\end{pmatrix}$$

$$\|$$

$$R(E) \qquad |\psi\rangle$$

$$\|$$

$$\boxed{\left(\hat{T}_d - e^{ikd}\,\hat{1}\right)|\psi\rangle = 0}$$

$$T_d(E,k) \qquad R'(E) = \frac{R(E+\delta) - R(E)}{\delta}$$

$$\boxed{R(E_0)\,|\psi_0\rangle = 0}$$

$$|\psi\rangle \neq \begin{pmatrix}0\\0\end{pmatrix}$$

$$E_0 = E + \Delta \qquad \Delta \text{ мало}$$

$$R(E_0)|0\rangle = R(E_0)|0\rangle \Delta R'|0\rangle$$

$$E_0 = E + \Delta$$

$$0 = R(E_0)|0\rangle = R(E)|0\rangle + R'(E)\cdot\Delta|0\rangle$$

$$[R']^{-1}\,\Big|\; -R(E)|0\rangle = R'(E)\cdot\Delta\,|0\rangle$$

$$\boxed{A\,|0\rangle = \Delta\,|0\rangle}$$

$$A = -[R']^{-1}\cdot R$$

$$\Delta = \begin{pmatrix} \Delta_1 \\ \Delta_2 \end{pmatrix}$$

$$\tilde{\Delta} = \min_{abs}(\Delta_{1,2})$$

$$\tilde{\Delta}_1,\ \tilde{\Delta}_2,\ \ldots\ \tilde{\Delta}_N \xrightarrow[|abs|]{} 0$$