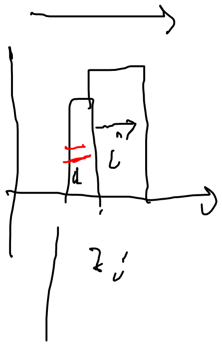

$i-1$

z_{i-1}

$$\psi_i = A_i e^{i h_i x} + B_i e^{-i h_i x}$$

$$\frac{\psi_i'}{i h_i} = \left[A_i e^{i h_i x} - B_i e^{-i h_i x} \right]$$

$$= \left[\qquad \right]_{i-1}$$

$$A_i e^{i h_i z_i} + B_i e^{-i h_i z_i} = A_{i-1} e^{i h_{i-1} z_i} + B_{i-1} e^{-i h_{i-1} z_i}$$

$$\cancel{h_i} \left[\qquad - \qquad \right] = \frac{h_{i-1}}{h_i} \left[\qquad - \qquad \right]$$

$$\gamma_i = h_{i-1} / h_i$$

$$A_i = \frac{1}{2} \left[A_{i-1} e^{i(h_{i-1} - h_i) z_i} (1 + \gamma_i) + B_{i-1} e^{-i(h_{i-1} + h_i) z} (1 - \gamma_i) \right]$$

$$B_i = \frac{1}{2} \left[A_{i-1} e^{i(h_{i-1} + h_i) z} (1 - \gamma_i) + \ldots \right.$$

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$$\begin{bmatrix}A_i\\B_i\end{bmatrix} = \begin{bmatrix}(1+\gamma_i)e^{i(k_{i-1}-k_i)z_i} & (1-\gamma_i)e^{-i(k_{i-1}+k_i)z_i}\\ (1-\gamma_i)e^{i(k_{i-1}+k_i)z_i} & (1+\gamma_i)e^{-ik}\end{bmatrix}\begin{bmatrix}A_{i-1}\\B_{i-1}\end{bmatrix}$$

$$\det \bar{M}_i = \gamma_i$$

$$= \bar{M}_i \begin{bmatrix}A_{i-1}\\B_{i-1}\end{bmatrix} \qquad \bar{M} = \prod_{i=1}^{N} M_i$$

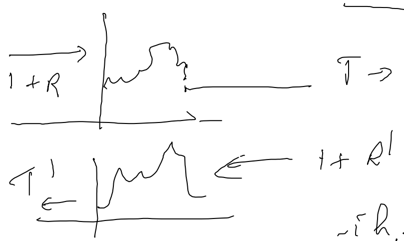
$$\psi_0 = e^{ik_0 z} + Re^{-ik_0 z} \longrightarrow \begin{bmatrix}1\\R\end{bmatrix} \qquad \det M = \frac{k_0}{k_f}$$

$$\psi_f = Te^{ik_0 z} \longrightarrow \begin{bmatrix}T\\0\end{bmatrix}$$

$$\begin{bmatrix}T\\0\end{bmatrix} = \bar{M}\begin{bmatrix}1\\R\end{bmatrix} = \begin{bmatrix}A & B\\C & D\end{bmatrix}\begin{bmatrix}1\\R\end{bmatrix}$$

$$T = A + BR$$

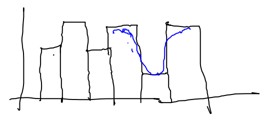
$$0 = C + DR \qquad \boxed{R = -C/D} \qquad T = A - BC/D = \det M / D$$



$$\bar{M}\begin{bmatrix}0\\T'\end{bmatrix} = \begin{bmatrix}R'\\1\end{bmatrix}$$

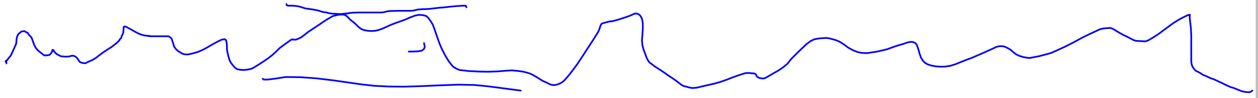
$$e^{-ik_1 z} + Re^{ik_1 z}$$

$$T'e^{-ik_0 z}$$



Rough Surfaces

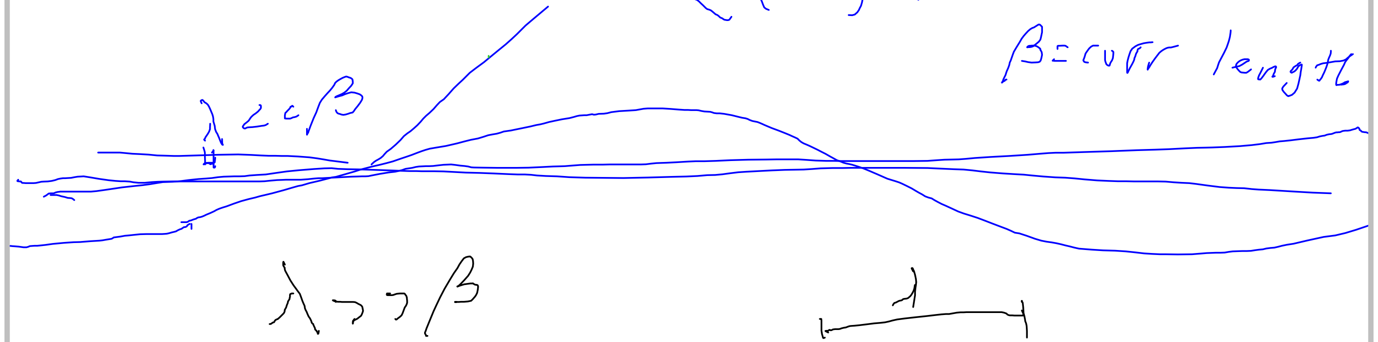
$z(x,y)$



$\langle(\delta z)^2\rangle$

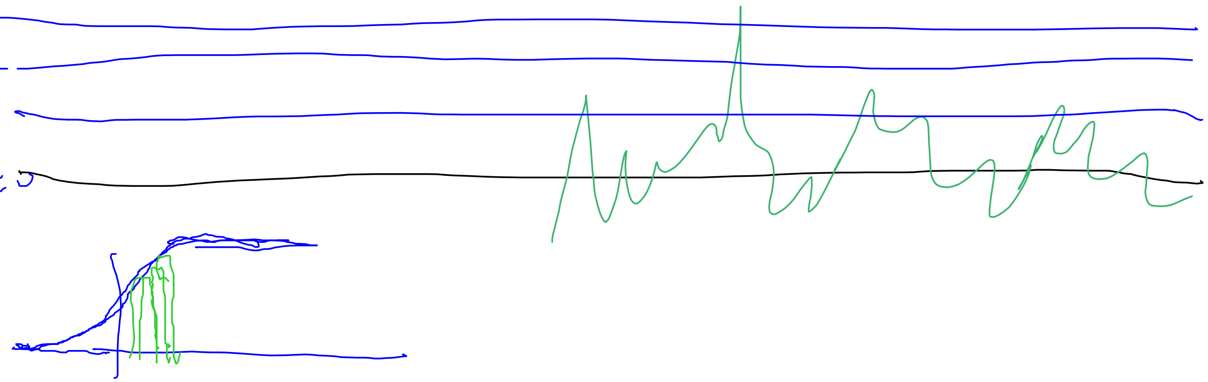
β = corr length

$\lambda \ll \beta$

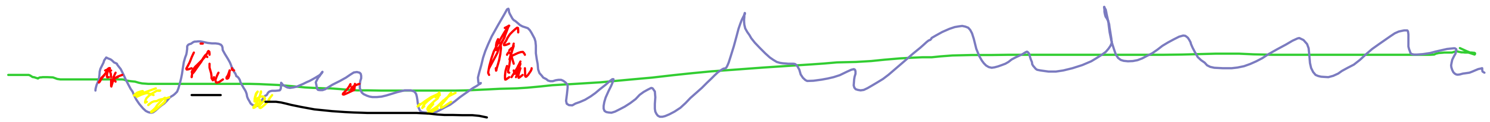


$\lambda \gg \beta$

d



$z = 0$



$z(x,y)$

$$f(Q) = \int (na)(\vec{r})\, e^{i\vec{Q}\cdot\vec{r}}\, d^3r$$

$$d^3r = z\, d^2\rho$$

$$f(Q) = (na)_0 \int z\, e^{iQ\cdot r}\, d^2\rho$$

$$|f(Q)|^2 = (na)^2 \int d^2\sigma\, d^2\sigma' \langle z(\rho)\, z(\rho')\rangle e^{iQ\cdot(\rho-\rho')}$$