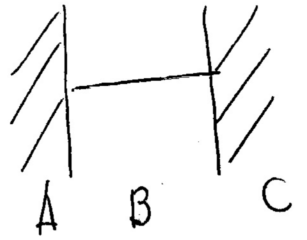


$$\left[-\frac{\hbar^2}{2m} + U_0(r) + V(r)\right]\psi(r) = E\,\psi(r)$$

$$[H_0 + V(r)]\psi(r) = E\psi(r)$$

$$[E - H_0]\psi(x) = V(r)\psi(r) = g(r)$$

$$\Rightarrow [E - H_0]\,G(r, r') = \delta(r - r')$$

$$\psi(r) = \int G(r, r')\, g(r')\, dr' \quad \text{(Green function) 정의}$$

$$[E - H_0]\phi^\alpha = 0$$

$$H_0\phi^\alpha = E^\alpha \psi^\alpha$$

$$\phi(x) = \Sigma C_\alpha \phi^\alpha(x)$$

$$g(x) = \Sigma D_\alpha \phi^\alpha(x)$$

$$[E - H_0]\Sigma C_\alpha \phi^\alpha = \Sigma D_\alpha \psi_\alpha$$

$$\Rightarrow \Sigma [E - E^\alpha] C_\alpha = \Sigma D_\alpha \phi^\alpha$$

$$\boxed{\therefore C_\alpha = \frac{D_\alpha}{E - E_\alpha}}$$

$$C_\alpha = \langle \phi^\alpha | \psi \rangle$$

$$D_\alpha = \langle \phi^\alpha | g \rangle$$

$$\psi(x) = \Sigma \int \phi^\alpha(x')\phi(x')\,dx'\,\phi^\alpha(x)$$

$$\psi(x) = \sum_\alpha \frac{D_\alpha}{E - E^\alpha}\,\phi^\alpha(x)$$

$$= \sum_\alpha \int \frac{\phi^\alpha(x')\, g(x')\, dx'\, \phi^\alpha(x)}{E - E^\alpha} \quad \leftarrow \text{operator로 사용}$$

$\hat{G}(r\,r')$

$$\psi(r) = \int \sum_\alpha \frac{\phi^\alpha(r')\phi^\alpha(r)}{E - E^\alpha}\, g(r')\, dr' = \int G(r r')\, g(r')\, dr'$$

($E^\alpha \leftarrow H_0$)

$$\rho = \begin{bmatrix} f(\varepsilon_1-\mu) & 0 & 0 \\ & f(\varepsilon_2-\mu) & \\ & & f(\varepsilon_N-\mu) \end{bmatrix}.$$

$$J = \begin{bmatrix} \frac{\hbar k_1}{m} [J_1 \ldots & 0 \\ 0 & \frac{\hbar k_2}{m} J_2 \\ & & \ddots \end{bmatrix}.$$

} continuous plane wave.

$$I = 2(1-g)\left[\mathrm{Trace}(\rho_{\mu} J) - \mathrm{Trace}[\rho_{\mu_2} J] \right].$$

$$\Sigma J f(\varepsilon-\mu_1) + J f(\varepsilon-\mu_2).$$

$$\psi(r) = \int \sum_{\alpha} \frac{V(r')\psi(r')\psi^{\alpha}(r)\psi^{\alpha}(r)}{E - E^{\alpha}} dr \qquad G(rr').$$

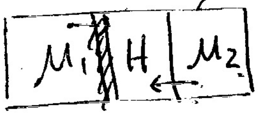
$$V(r')G(rr') = \delta(r-r').$$

$$= \int V(r')\, G(r,r')\, \psi(r')\, dr'$$

$[S] \rightarrow S_1 + S_2 \geq 0$

$H \leq 0$ P

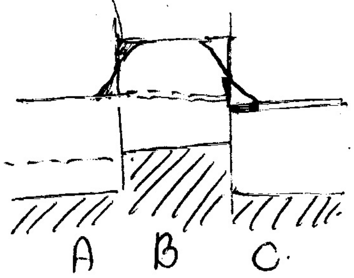
$G \leq 0$. T.P.



$$\left[-\frac{\hbar^2}{2m}\nabla^2 + u(r) + V(r)\right]\phi^{\alpha} = E^{\alpha}\phi^{\alpha}.$$

$$\rho(r) = \sum_{\alpha} \psi_{\alpha}(r)\psi_{\alpha}^{*}(r).$$

$$f_{\alpha}(\varepsilon_{\alpha} - \mu) \;//\; \frac{1}{1 + \exp^{(\varepsilon_{\alpha} - \mu)/k_B T}}$$

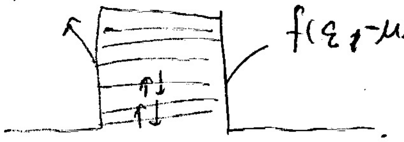


$$J = \frac{i\hbar}{2m}\int [\psi \nabla\psi^{*} - \psi^{*}\nabla\psi]\, dA.$$

$\longrightarrow \frac{e^{ik\cdot r}}{\sqrt{V}}$ $= \frac{\hbar k}{mL}$

$\longleftarrow \frac{-e^{ikr}}{\sqrt{V}}$ $= I.$

(current) = (charge) × (계면에서 지나간 전자 수)



$$I = 2 \times (-q) \sum_{k} \frac{\hbar k}{mL}\left[f(\varepsilon_i - \mu_1) - f(\varepsilon_k - \mu_2)\right]$$

on the left · on the right

$\frac{\hbar k}{mL} \rightarrow \frac{2\pi}{L} n x$

$$\Rightarrow 2 \times (-q) \times \frac{L}{2\pi}\int \frac{\hbar k}{mL} dk \left[f(\varepsilon - \mu_1) - f(\varepsilon - \mu_2)\right]$$

$$2(-q)\frac{L}{2\pi}\cdot\frac{\hbar}{mL}\cdot\frac{m}{\hbar/2\pi}\int d\varepsilon\,(f(\varepsilon - \mu_1) - f(\varepsilon - \mu_2)).$$

$$I = \frac{2(-q)}{L}\int d\varepsilon\,[f(\varepsilon - \mu_1) - f(\varepsilon - \mu_2)].$$