$H = H_0 + V.$

ψ_0

ψ_2

ψ_1

$$E_2^{(0)} = \langle 2|H_0|2\rangle + \langle 2|V|2\rangle\lambda + \sum_{\substack{m=1\\ m\neq 2}} \frac{\langle 2|V|m\rangle\langle m|V|2\rangle}{(E_2^{(0)} - E_m^{(0)})}\lambda^2 t.$$

$H = H_0 + V. \qquad |V| \ll |H_0|$

$H\psi = E\psi$

$$(H_0 + \lambda V)(\psi_0 + \lambda\psi_0^{(1)} + \lambda^2\psi_0^{(2)} + \cdots) = (E_0 + \lambda E_0^{(1)} + \lambda^2 E_0^{(2)} + \cdots)(\psi_0 + \lambda\psi_0^{(1)} + \lambda^2\psi^{(2)} + \cdots$$

① $H_0\psi_0 = E_0\psi_0$ $\qquad \underline{\psi = \psi_0 + \lambda\psi_0^{(1)} + \lambda^2\psi_0^{(2)}}$

② $(H_0\psi_0^{(1)} + V\psi_0) = (E_0\psi_0^{(1)} + E_0^{(1)}\psi_0)$ $\qquad \langle 0|0\rangle + \lambda\langle 0|0^{(1)}\rangle + \lambda^2\langle 0|0^{(2)}\rangle + \cdots = 1.$

$\langle 0|0\rangle = 1$ orthogonal

$\langle 0|\psi\rangle = 1$ intermediate normalization

③ $(H_0\psi_0^{(2)} + V\psi_0^{(1)}) = (E_0\psi_0^{(2)} + E_0^{(1)}\psi_0^{(1)} + E_0^{(2)}\psi_0)$

$= \sum\langle n|\psi_0^{(2)}\rangle|n\rangle$

$C_n^{(1)} = \phi_n^*\phi^{(1)}$

① $\phi_i^{(1)} = \sum C_n^{(1)}\phi_n$ $\qquad$ (F.S) $\int\phi_m^*\phi^{(1)} = \sum C_n^{(1)}\underbrace{\int\phi_m^*\phi_n}_{\delta mn} = \sum\langle\phi_n|\phi^{(1)}\rangle$

② $\phi_i^{(2)} = \sum C_n^{(2)}\phi_n = \sum\langle n|\psi^{(2)}\rangle|n\rangle$

③ $\phi_i^{(3)} = \sum C_n^{(3)}\phi_n.$

① $\psi_0^{(1)} = \sum'_{\substack{k=0\\ k\neq 0}}\langle k|\psi_0^{(1)}\rangle\psi_k^{(0)}$

① $E_0 = \langle 0|H_0|0\rangle$

$E_0^{(1)} = \langle 0|V|0\rangle$

$E_0^{(2)} = \langle 0|V|\psi_0^{(1)}\rangle \qquad \sum_n{}'\langle n|\psi_0^{(1)}\rangle\langle\psi_0^k$

$E_0^{(k)} = \langle 0|V|\psi_0^{k-1}\rangle.$

$\int \phi_n^{(*)}$ $\quad \langle m|V|m\rangle$.

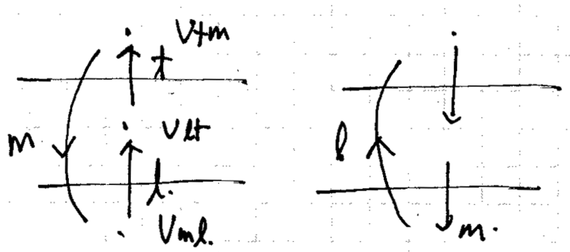
$$(H_0 - E_m)\left(\sum_K \langle K|\phi_m^{(2)}\rangle|K\rangle\right) = (-V + E_m^{(1)})\,\phi_m^{(1)} + E_0^{(2)}\phi_m^{(0)}.$$

$$\sum (E_K^{(0)} - E_m^{(0)})\langle K|\phi_m^{(2)}\rangle\langle n|K\rangle = \langle n|\,(-V + \langle m|V|m\rangle)\,|\phi_m^{(1)}\rangle$$

$$\langle n|\phi_n^{(2)}\rangle = \frac{\langle n|V|\phi_m^{(1)}\rangle}{E_n^{(0)} - E_m^{(0)}} - \langle m|V|m\rangle\langle n|\phi_m^{(1)}\rangle.$$

$$\langle n|V|\phi_n^{(1)}\rangle = \sum \langle n|V|t\rangle\langle t|\phi_m^{(1)}\rangle$$

$$\langle n|\phi_m^{(1)}\rangle = \frac{\langle n|V|m\rangle}{\langle E_n^{(0)} - E_m^{(0)}\rangle}.$$



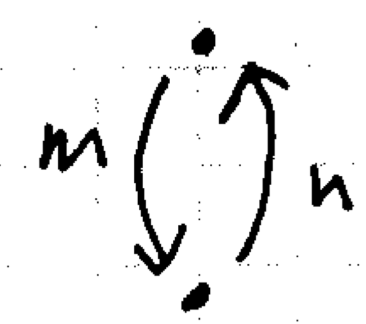
$$\sum_l \sum_t \frac{V_{ml}\cdot V_{lt} + V_{tn}}{(E_m^{(0)} - E_l^{(0)})(E_m^{(0)} - E_t^{(0)})} - \sum_l \frac{V_{ml}V_{lm}\cdot V_{mm}}{(E_m^{(0)} - E_l^{(0)})^2}.$$

② $(H_0-E_0)\sum \langle n|\phi_0^{(1)}\rangle |n\rangle = \langle 0|V|0\rangle - V|0\rangle$

$$\sum \langle n|\phi_0^{(1)}\rangle (E_n^{(0)}-E_0)|n\rangle = \langle 0|V|0\rangle - V|0\rangle.$$

$$\langle m^* \Rightarrow \langle n|\phi_0^{(1)}\rangle = \frac{\langle n|V|0\rangle}{\langle E_0 - E_n^{(0)}\rangle}$$

$$E_n^{(2)} = \langle m|V|\psi_m^{(1)}\rangle$$
$$= \sum_n \langle m|V|n\rangle\langle n|\psi_m^{(1)}\rangle.$$
$$= \sum \langle m|V|n\rangle \frac{\langle n|V|m\rangle}{(E_m^{(0)}-E_n^{(0)})}.$$



$$\frac{V_{mn}V_{nm}}{E_m^{(0)}-E_n^{(0)}} \qquad V_{mn} \rightarrow \langle m|V|n\rangle.$$

$$E_m^{(1)} = \langle m|V|n\rangle.$$

$$E_m^{(3)} = \langle m|V|\psi_m^{(2)}\rangle.$$
$$= \sum_n \langle m|V|n\rangle\langle n|\psi_m^{(2)}\rangle$$
$$= \sum \langle m|V|n\rangle \underbrace{\frac{\langle n|V|K\rangle\langle K|\psi_m^{(1)}\rangle}{E_m^{(0)}-E_n^{(0)}}}$$

$\langle n|$

$$(E_m^{(0)}-E_n^{(0)})\langle n|\psi_m^{(2)}\rangle = \langle n|V|\psi_m^{(1)}\rangle.$$

$$(E_0-H_0)\sum \langle n|\psi_m^{(2)}\rangle|n\rangle = \langle n|V|m^{(1)}\rangle - E_m^{(1)}|m^{(1)}\rangle - E_0^{(2)}|m\rangle.$$
$$= \langle n|V|m\rangle.$$
$$\langle n|\psi_m^{(2)}\rangle = \frac{\langle n|V|\psi_m^{(1)}\rangle}{E_m^{(0)}-E_n^{(0)}}$$

$$\langle H_0\psi_m^{(2)} + V\psi_m^{(1)}\rangle = \langle E_0\psi_m^{(2)} + E_0^{(1)}\psi_m^{(1)} + E_0^{(2)}\phi_m^{(0)}\rangle$$

$$H_0\psi_m^{(2)} \to \sum_K \langle K|\psi_m^{(2)}|K\rangle.$$