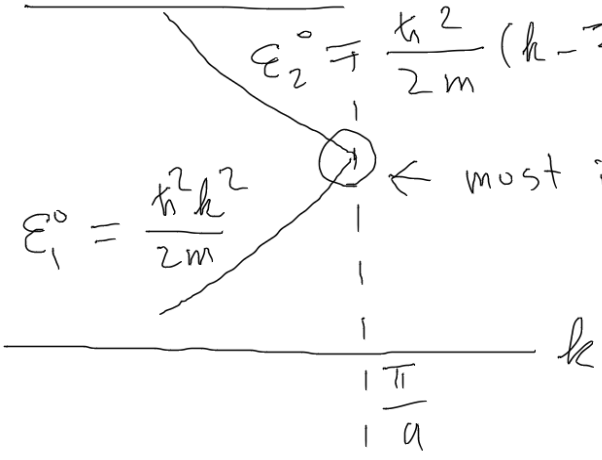
BARE BONE NEARLY FREE ECECTRON BAND



← most important when crystal pot. is small (nearly free e^-)

More generally $\varepsilon_1^\circ = \frac{\hbar^2}{2m}\vec{k}^2$

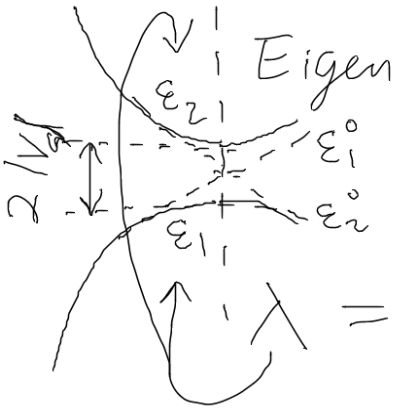
$$\varepsilon_2^\circ = \frac{\hbar^2}{2m}\left(\vec{k} - \vec{G}\right)^2$$

Zone boundary $|\vec{k}| = |\vec{k} - \vec{G}|$

Unperturbed states $|\vec{k}\rangle$ and $|\vec{k} - \vec{G}\rangle$

Relevant pot $V_{\vec{G}} \sim \int d\vec{x} V(\vec{x}) e^{-i\vec{G}\cdot\vec{x}}$

(Also $V_0 \sim \int d\vec{x}\, V(\vec{x})$ → But this simply shifts energies ε_1°, ε_2° by the same amount --- just a constant)



Eigenvalue prob. $\begin{vmatrix} \varepsilon_1^\circ - \lambda & V_{\vec{G}}^* \\ V_{\vec{G}} & \varepsilon_2^\circ - \lambda \end{vmatrix} = 0$

$$\lambda = \frac{\varepsilon_1^\circ + \varepsilon_2^\circ}{2} \pm \frac{1}{2}\sqrt{\left(\varepsilon_1^\circ - \varepsilon_2^\circ\right)^2 + 4|V_G|^2}$$

⇒ group velocity, FS distortion, standing wave, effective mass in semi-conductor ...