Review : Konsep Pita Energi (via TB model)

$$\vec{a}_i \cdot \vec{b}_j = 2\pi\delta_{ij}$$

isolator/insulator : pita kondusi

semikonduktor

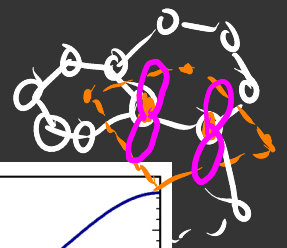
konduktor/metal

E_F

pita valensi

$C : 1s^2 2s^2 2p^2$ → $s\ p_x p_y p_z$

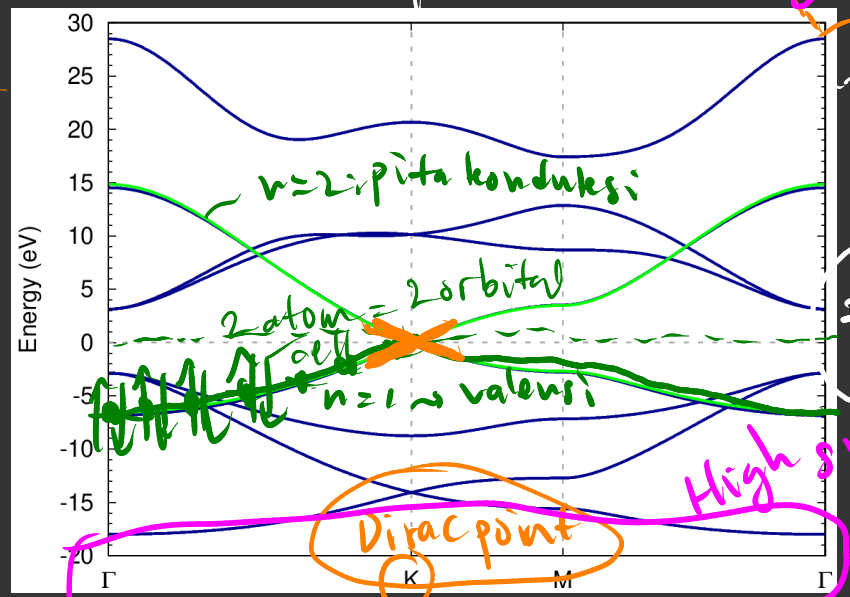
Graphene :



→ ultrasimplifikasi ✗

Sistem kristal realistis :
- Teorema Bloch & periodisitas ✓
- Fungsi Bloch

Silicon : diamond = 2 fcc



n=2 : pita kondusi

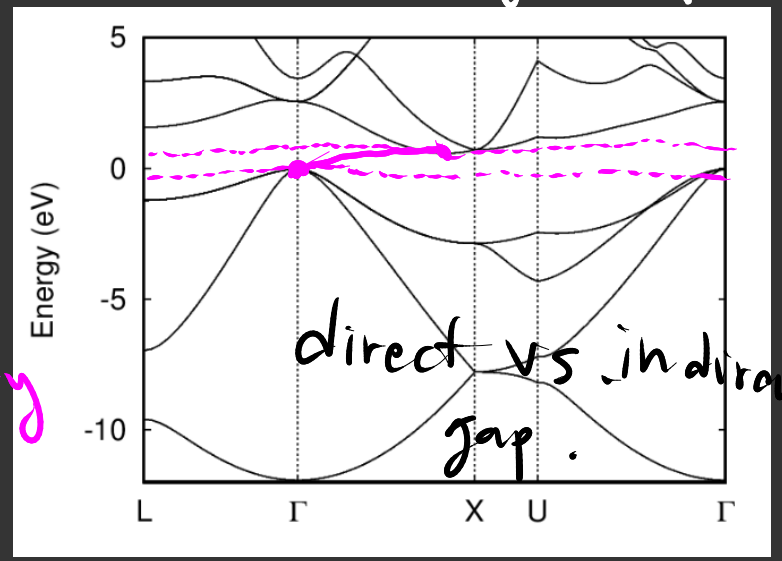
2 atom = 2 orbital

n=1 ~ valensi

E_F

High symmetry points

Dirac point



direct vs indirect gap.

TB model

$E(k, n)$

k : ruang resiprok (ruang momentum)

cahaya : $E = pc = \hbar c k$

$HC = ESC \rightarrow E(k, n)$

light - matter interaction

Traditional QM : $\hat{H} = \hat{K} + \hat{V}$ → 1st quantization

$= -\frac{\hbar^2}{2m}\vec{\nabla}^2 + V(\vec{r})$

$\Psi_N(\vec{r}, t)$: N dimension complicated.

$HC = ESC$

many body QM : meminjam QFT

operator medan.
(kuantisasi medan = 2nd)

States : dihasilkan dari
"number representation" : $\hat{n} = \tilde{a}^+ \tilde{a}$

$\hat{n}_i|\Psi\rangle = a_i^+ a_i|\Psi\rangle$; commutation relation {boson, fermion} kreasi anihilasi