BARE BONE TIGHT BINDING

Hydrogen 1s in 1D

$H = T + V$ $\quad$ V: periodic pot.

$$|\psi\rangle = \sum_n e^{ikna} |n\rangle$$

$\langle n|H|n\rangle \equiv \varepsilon$ (throw in atomic energy -2β and so on)

$\langle m|H|n\rangle = -t$ if $m - n = \pm 1$

(keep nearest neighbor only)

t is called a "hopping" matrix element

$\langle m|n\rangle = \delta_{mn}$ (somewhat of a over-simplification but an often-used approx)

$H|\psi\rangle = \varepsilon_k |\psi\rangle$

$\langle m|H|\psi\rangle \Rightarrow e^{ikna}\varepsilon_k$

$$\boxed{\varepsilon_k = \varepsilon - 2t\cos ka}$$

If $t \to 0$, ε_k becomes flat

$m^* \to \infty$

$t \to \infty$, ε_k becomes very wide

$m^* \to 0$

↑ ease of hopping or hopping probability or tunneling probability