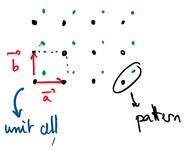
Reminder : Cristal lattice , Metal bonds

Tuesday, 25. October 2022 09:40

① Real and Reciprocal lattices.



lattice = periodic arrangement of atoms

$\vec{R}_{uvw} = u\vec{a} + v\vec{b} + w\vec{c}$

"Real space" $u, v, w \in \mathbb{Z}$

Reciprocal space: Fourier (conjugate) space of the real space

$\vec{G}_{hkl} = h\vec{a}^* + k\vec{b}^* + l\vec{c}^*$

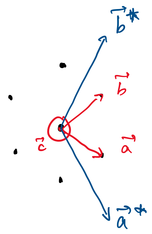
with $\vec{a}.\vec{a}^* = \vec{b}.\vec{b}^* = \vec{c}.\vec{c}^* = 2\pi$

and $\vec{b}.\vec{a}^* = \vec{c}.\vec{a}^* = 0$

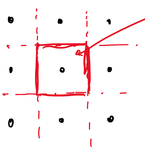
$\Leftrightarrow$ $\vec{a}^* = (\vec{b} \times \vec{c}) \times \frac{2\pi}{V}$ ⇝ unit cell Volume

$\vec{b}^* = (\vec{c} \times \vec{a}) \times \frac{2\pi}{V}$

$\vec{c}^* = (\vec{a} \times \vec{b}) \cdot \frac{2\pi}{V}$

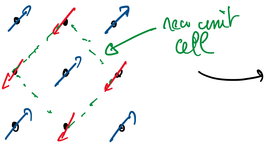


* Wigner-Seitz cell = Assembly of points which are closer from the origin than from any other point of the lattice



⇒ First Brillouin Zone is the Wigner-Seitz cell of the reciprocal space.

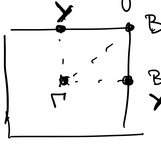
Ex: Doubling of the unit cell in real space (case of Antiferromagnetism)

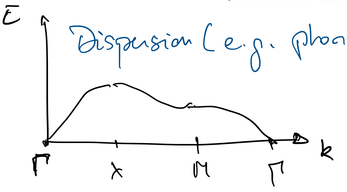


Special (high symmetry) points

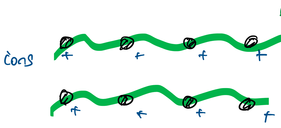
Origin of the reciprocal space

Γ = gamma point = (0,0,0)





② Metallic State



* Metallic bonding
* Conductions are shared between all the atoms ⇒ delocalized
* delocalized act as a "glue" that holds together the ionic lattice.

. Few consequences:

i) non-directional bonds = metals are ductile and malleable

ii) very good electrical and heat conduction

iii) Efficient screening of electromagnetic waves ⇒ metals are shiny

③ Descriptions of electrons in solids

Two limits