Day-7

→ **Lattice Planes** ↓

Hyperplane → 1D lower than n-D plane

→ **Directions in a lattice** → line, plane

→ **Boundary surfaces** – extension of crystallographic hyperplane

→ **Crystallographic hyperplane** –

3 non-collinear points : all the lattice vectors that exist between these points

Nomenclature or a notation to identify/name these planes → in line with what was developed for directions.

Let us consider a triclinic lattice (a, b, c).
A 3D object is formed by the intersection of planes.

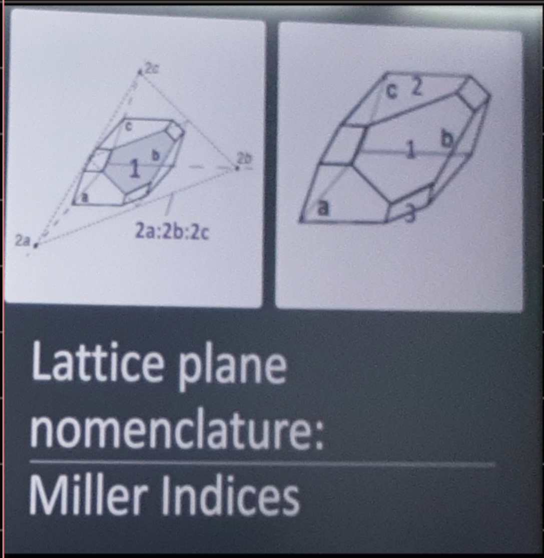
Consistent approach to nomenclature.

1.) Extend this plane so that the crystallographic axes intersect this plane → intercepts.

$2\cancel{a}$ $2\cancel{b}$ $2\cancel{c}$

$2 \quad 2 \quad 2 \xrightarrow{\text{written as}} (2 \quad 2 \quad 2)$

↓
differentiate from writing a vector.



2.) Plane 2 ∥ to $\vec{a}\vec{b}$ plane. intercepts the c-axis at $1 \times c$.

$(\infty \quad \infty \quad 1)$

↓ to get rid of ∞ (take reciprocal)

$\left(\frac{1}{\infty} \quad \frac{1}{\infty} \quad \frac{1}{1}\right)$

↓

$(0 \quad 0 \quad 1)$

Do the same for $(2 \quad 2 \quad 2)$

↓ (keep universal)

$(1/2 \quad 1/2 \quad 1/2)$

↓ convert to integers

$(1 \quad 1 \quad 1)$

3.) Plane 3: $\frac{7a}{4} \quad 2b \quad \infty c$

$(7/4 \quad 2 \quad \infty)$

↓ Reciprocal

$(4/7 \quad 1/2 \quad 0)$

↓ Integers

$(8 \quad 7 \quad 0)$

→ what if plane passes origin?

- Displace it along its normal.
- Determine the intercepts of the plane with the 3 crystallographic axes (a, b, c). Let them be s_1, s_2, s_3.
- Take reciprocal : $\left(\frac{1}{s_1} \quad \frac{1}{s_2} \quad \frac{1}{s_3}\right)$
- multiply by LCM to convert them to integers.

(h k l)

→ (h k l) → determine distance from origin (d).

Along normal, by 'd', shift the plane; we get a set of planes

→ Symmetry related or family of planes

CP : (1 1 0) related (1 0 1) obtained by rotation

↓

degeneration

TP : (1 1 0) (1 0 1)

Not related

CP: (1 1 0) , (1 0 1) , (0 1 1),

$(1 \bar{1} 0)$, $(1 0 \bar{1})$, $(0 1 \bar{1})$ $\times 2 = 12$

↓

degeneracy

Denoted by $\{1\,1\,0\}$ $\longrightarrow$ set of symmetry-related planes