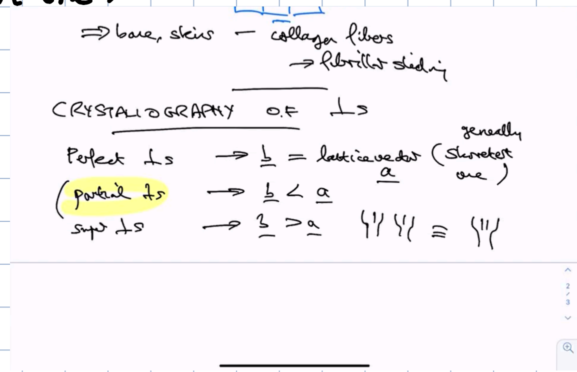
Crystallography of ⊥s

Perfect ⊥s → $\underset{\sim}{b}$ = lattice vector (generally shortest one)

Partial ⊥s → $\underset{\sim}{b} < \underset{\sim}{a}$

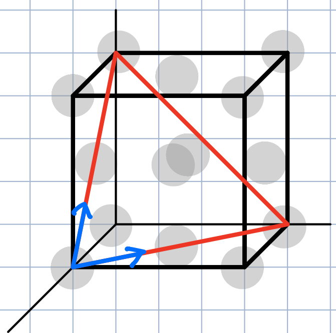
Super ⊥s → $\underset{\sim}{b} > \underset{\sim}{a}$



the closest packed !

Face-centered Cubic (FCC) ABCABC ···

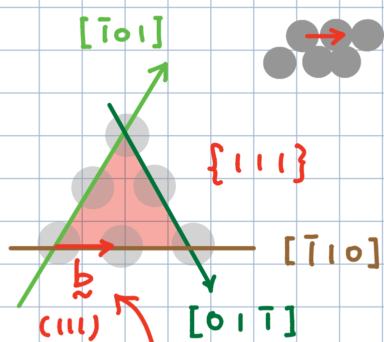
→ Al, Cu, γ-Fe



Closed packed planes
→ farest apart {1 1 1}

closed packed directions ⟨1 $\bar{1}$ 0⟩

} slip plane



$a/2\,[\bar{1}10]$ perfect ⊥

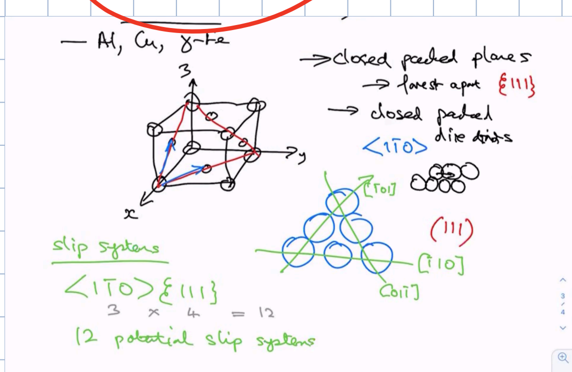
$|b| = \sqrt{a^2/4 + a^2/4} = a/\sqrt{2}$

Slip system

$\langle 1\bar{1}0\rangle \{111\}$

3 × 4 = 12

12 potential slip system

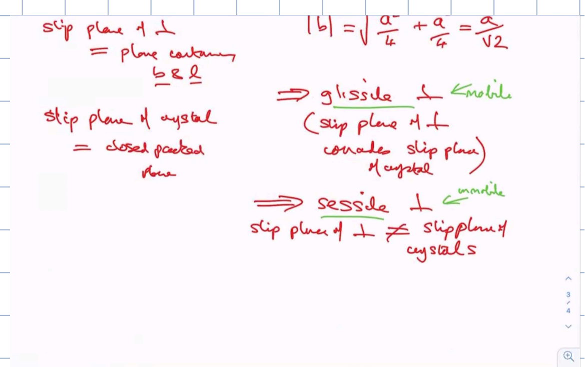


Slip plane of ⊥ = plane ? $\underset{\sim}{b}$ & $\underset{\sim}{l}$

slip plane of crystal = closed packed plane

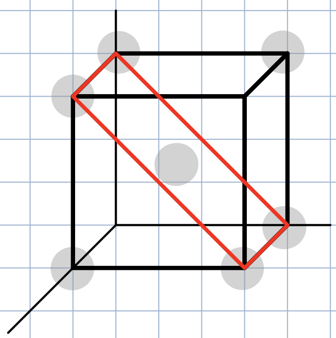
glisside ⊥ (slip plane of ⊥

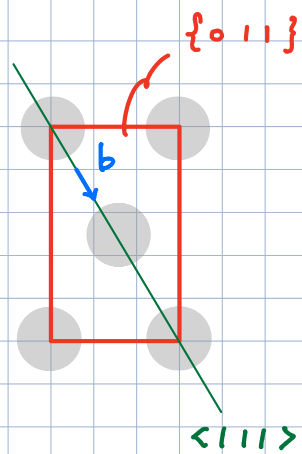
sesside ⊥ (slip plane of ⊥ ≠ slip plane of crystals)

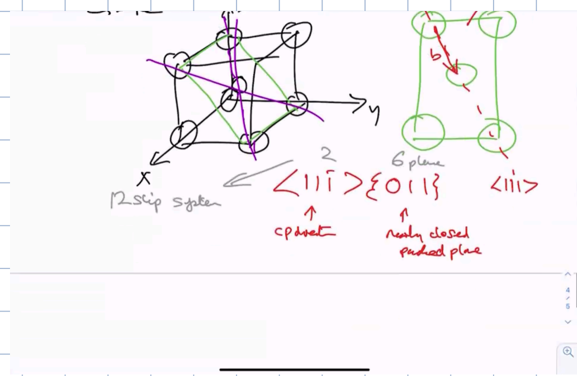


Body-centered Cubic (BCC)

→ α-Fe







<1 1 1> {0 1 1}
2 × 6 planes = 12 slip system

bcc $\frac{a}{2}[11\bar{1}]$ $|b| = \sqrt{\frac{a^2}{4}+\frac{a^2}{4}+\frac{a^2}{4}}$

glisside ⊥ $= \sqrt{3}\,\frac{a}{2}$

$$\text{Fcc} \longrightarrow \langle \overset{3}{1\bar{1}0} \rangle \{\overset{4}{111}\}$$

c.p. direction × c.p. planes → 12 slip systems

$\frac{a}{2}[1\bar{1}0]$, $|b| = a/\sqrt{2}$

$$\text{BCC} \longrightarrow \langle 111 \rangle \{011\}$$

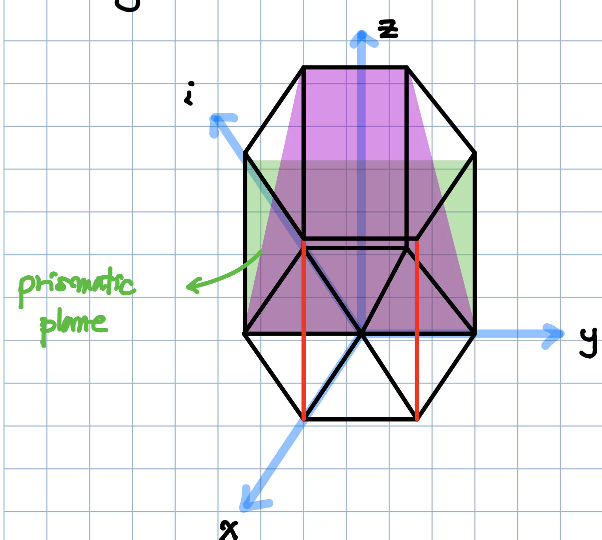
c.p. direction × nearly closed planes → 12 slip systems

$\frac{a}{2}[11\bar{1}]$, $|b| = \sqrt{3}\, a/2$

glisside ⊥ ≡ slip plane of ⊥ ($\underset{\sim}{b} \times \underset{\sim}{l}$) is same as plane of crystal (closed packed plane)

sessid ⊥ ≡

Hexagonal Closed Packed (Zr, Ti)

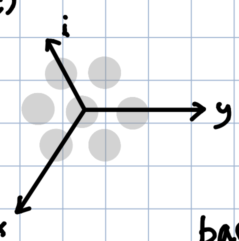


hkil — slip plane

(0001) closed packed plane

hkil

$i = -(h+k)$



$[\bar{1}2\bar{1}0]$

$[2\bar{1}\bar{1}0]$

pyramidal slip
$(10\bar{1}1) \cdot [\bar{1}2\bar{1}0]$
nearly c.p.

prismatic slip
$(10\bar{1}0)$ $[\bar{1}2\bar{1}0]$
nearly c.p.

c.p. direction

basal slip

$(0001)[\bar{1}2\bar{1}0]$

1 3 = 3 slip systems

Ductility in HCP is much less (∵ only has few # of slip systems)

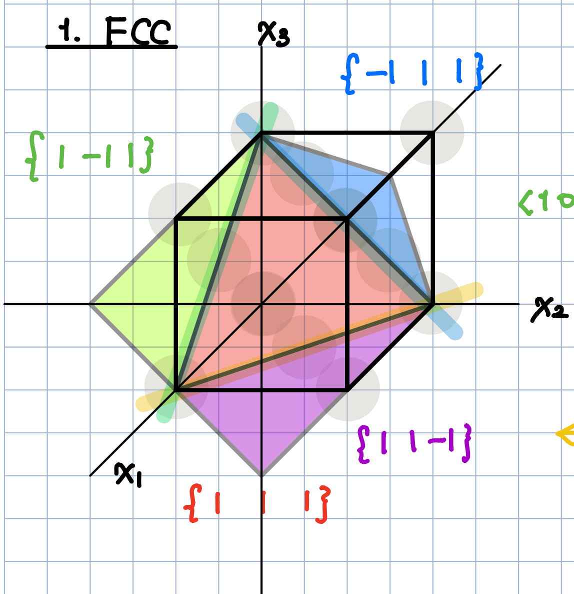
Crystal Structure	Slip Plane	Slip direction	# of Slip Systems
FCC	{1 1 1}	<1 1 0>	12
HCP	{0 0 1}	<1 1 0>	3
BCC	{1 1 0}	<1 1 1>	12

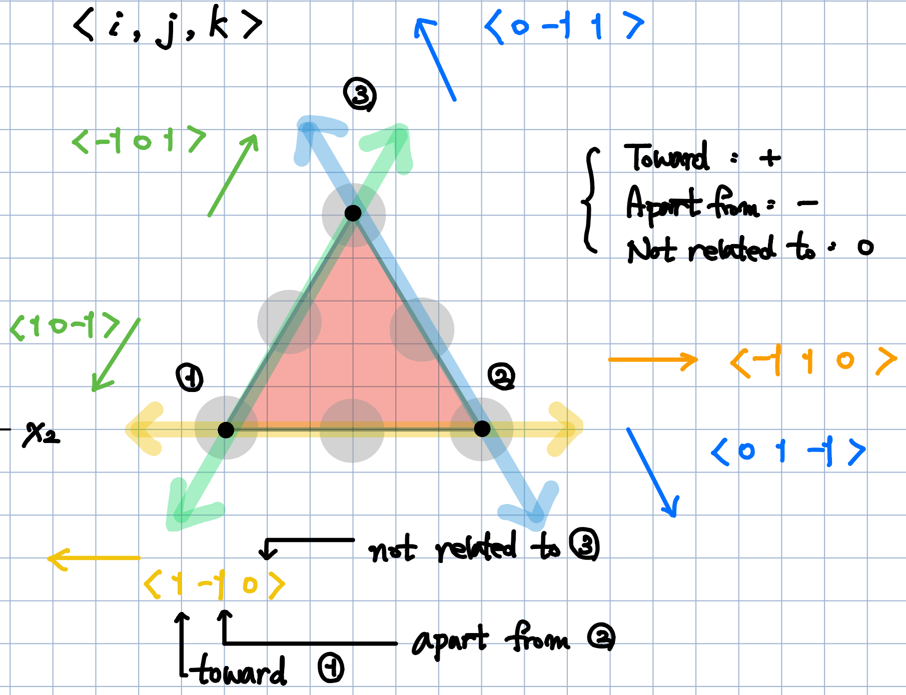
Identify close packed planes and directions in the metal systems.

Planes are denoted as $\{h, k, l\}$

Directions " " " $\langle i, j, k \rangle$

1. FCC





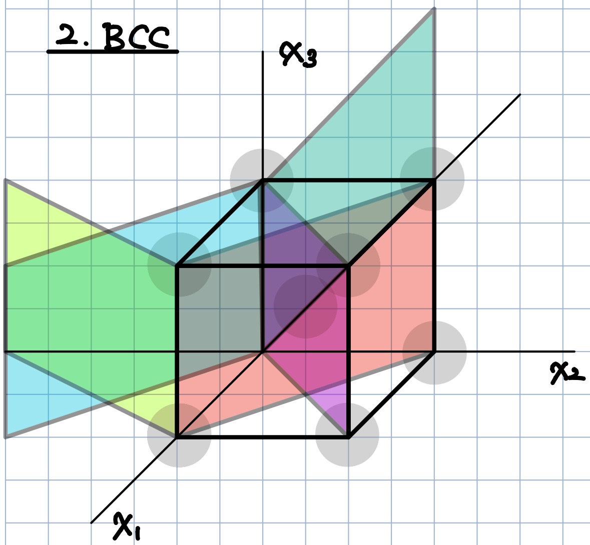
Toward : +
Apart from : −
Not related to : 0

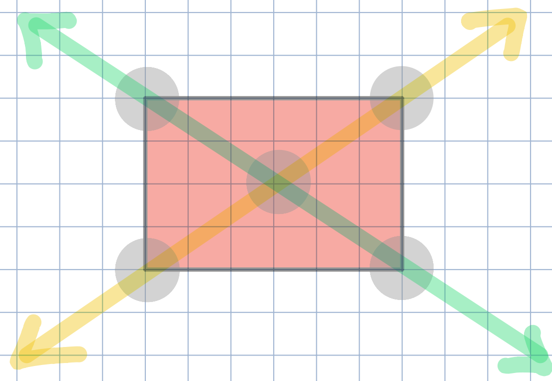
Plane : {1 1 1} Ans.

<1 1 0> Ans.

			Planes		Directions	Slip systems
FCC :	Plane {1 1 1}	$2^3 = 8$	$8/2 = 4$	×	3	12

2. BCC



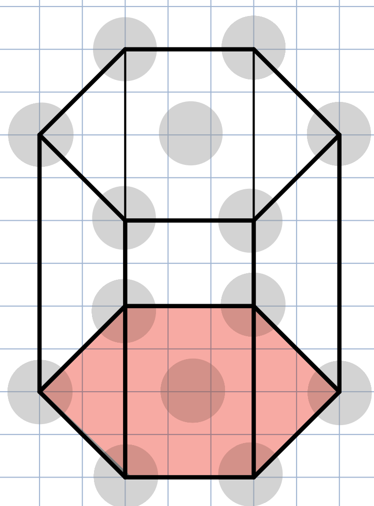


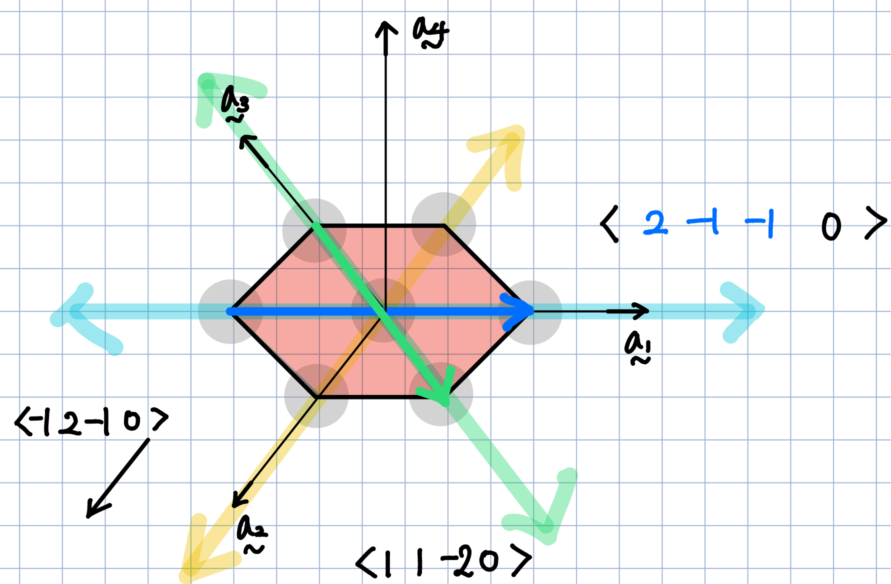
$\langle 1\ 1\ 1 \rangle$

Plane : $\{1\ 1\ 0\}$

				Planes		Directions	Slip systems
FCC :	Plane	$\{1\ 1\ 1\}$	$2^3 = 8$	$8/2 = 4$	×	3	12
BCC :	Plane	$\{1\ 1\ 0\}$	$3 \times 2^2 = 12$	$12/2 = 6$	×	2	12

3. HCP





Plane : $\{0\ 0\ 1\}$

				Planes		Directions	Slip systems
FCC :	Plane	$\{1\ 1\ 1\}$	$2^3 = 8$	$8/2 = 4$	×	3	12
BCC :	Plane	$\{1\ 1\ 0\}$	$3 \times 2^2 = 12$	$12/2 = 6$	×	2	12
HCP :	Plane	$\{0\ 0\ 1\}$		1	×	3	3