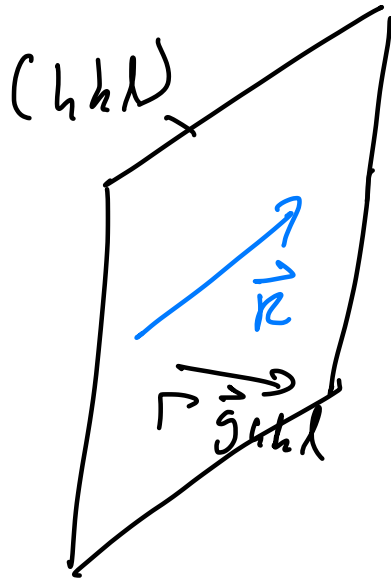


Weiss zone law

$$\text{If } [uvw] \parallel (hkl) : hu + kv + lW = 0$$

lattice vector $\vec{R} : [uvw]$

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

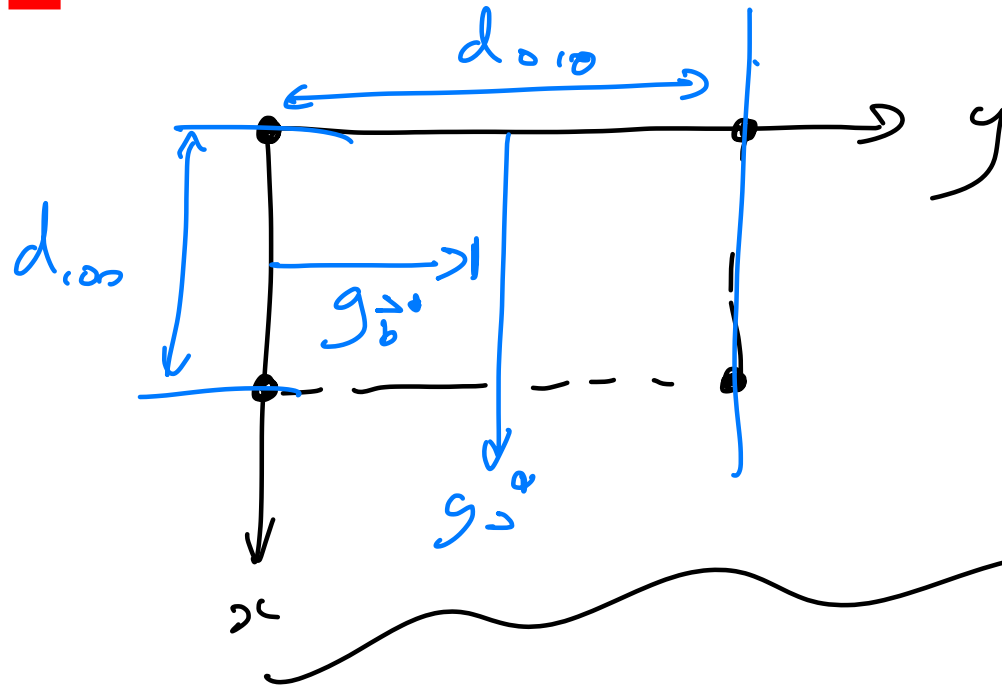
$$\text{Plane } (hkl) : \vec{g}_{hkl} = h\vec{a}^* + k\vec{b}^* + l\vec{c}^*$$

$$\vec{R} \perp \vec{g}$$

$$\Rightarrow \vec{R} \cdot \vec{g} = 0$$

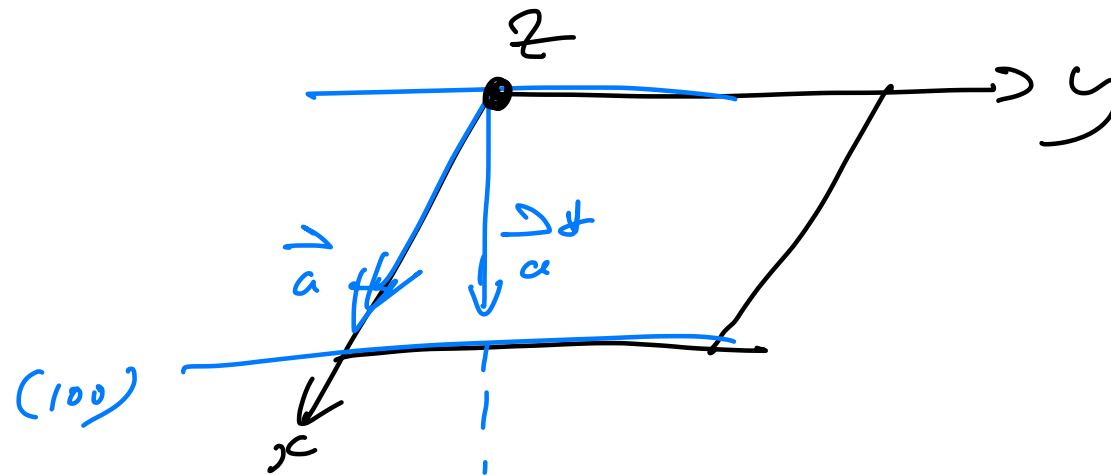
$$\Rightarrow u\vec{a} \cdot h\vec{a}^* + v\vec{b} \cdot h\vec{a}^* + w\vec{c} \cdot h\vec{a}^* + u\vec{a} \cdot k\vec{b}^* + v\vec{b} \cdot k\vec{b}^* + w\vec{c} \cdot k\vec{b}^* + u\vec{a} \cdot l\vec{c}^* + v\vec{b} \cdot l\vec{c}^* + w\vec{c} \cdot l\vec{c}^* = hu + kv + lW = 0$$

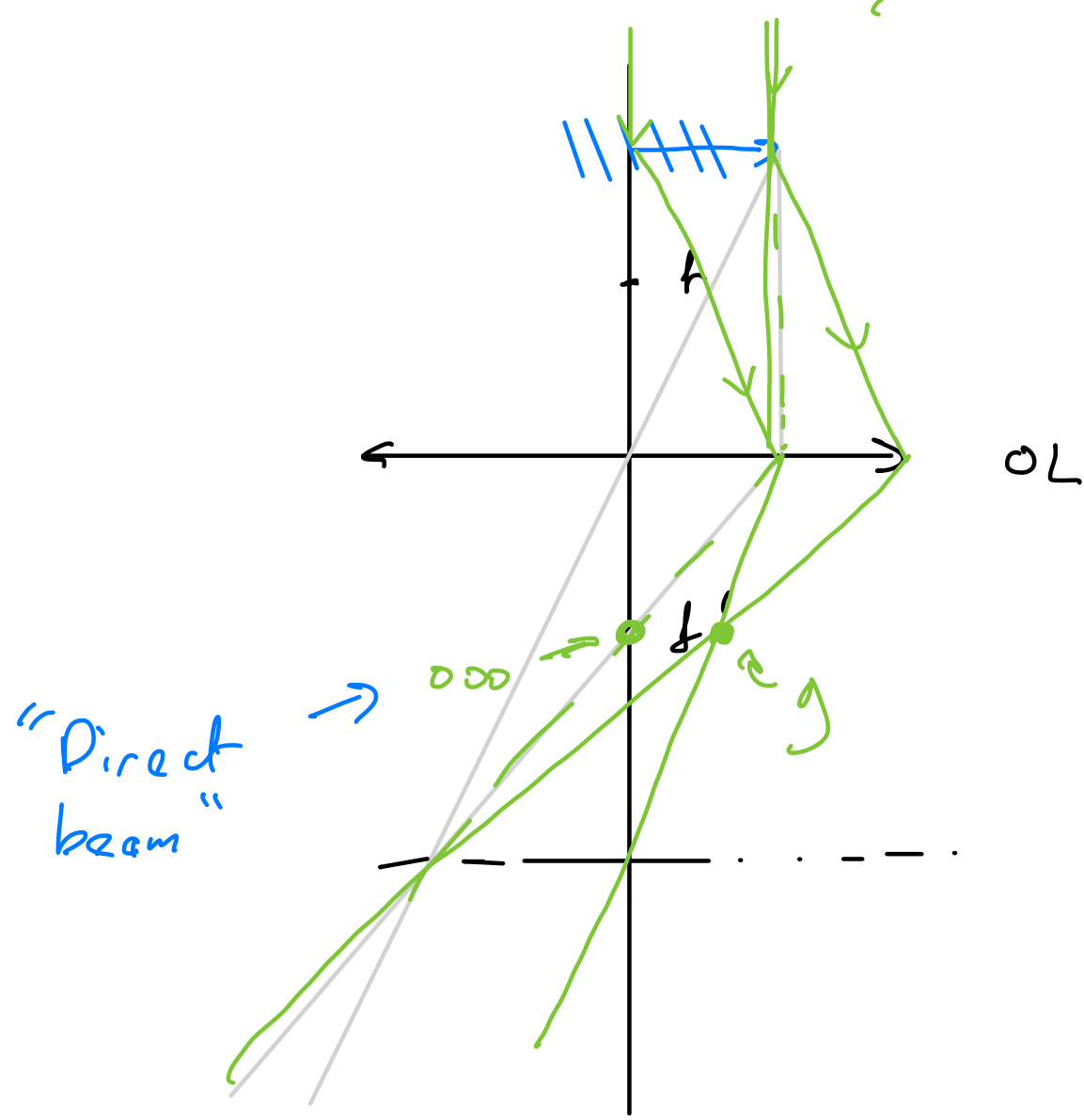
$$\begin{aligned} \vec{a} \cdot \vec{a}^* &= 1 \\ \vec{b} \cdot \vec{a}^* &= 0 \\ &\vdots \end{aligned}$$



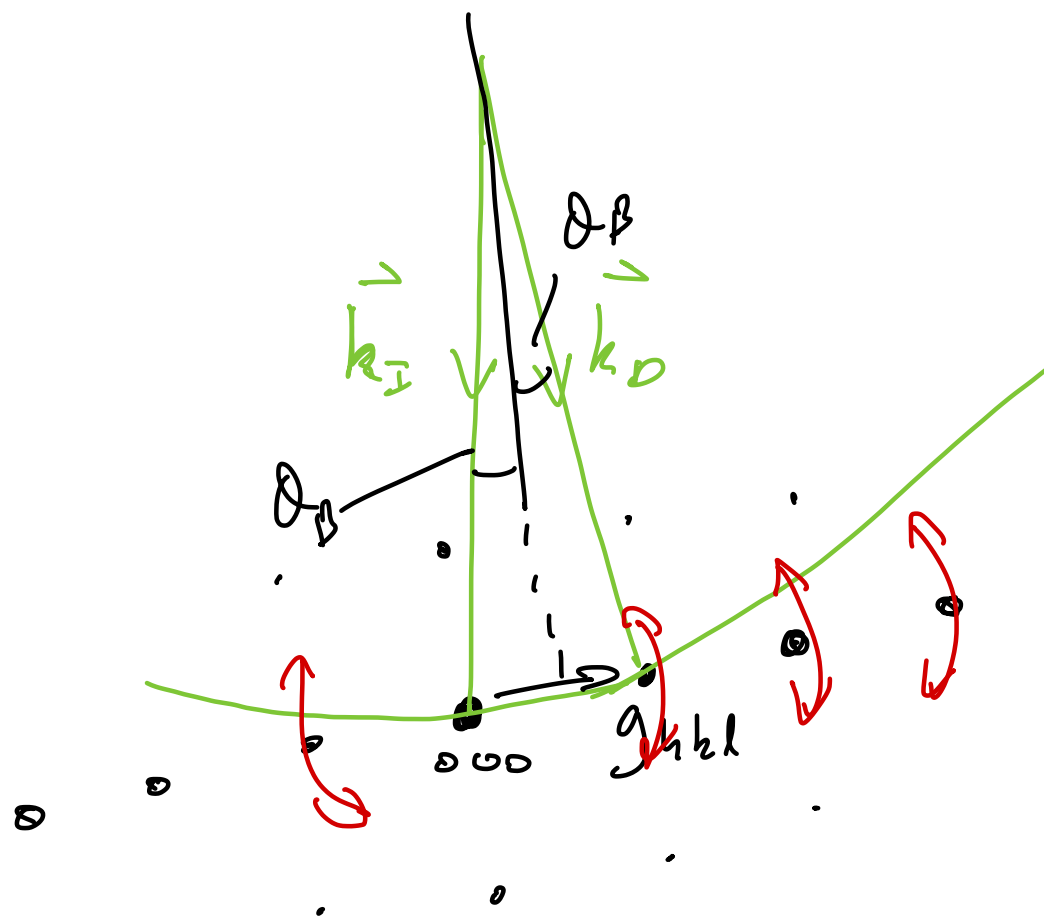
$$|\vec{a}^*| = \frac{1}{d_{100}}$$

$$|\vec{b}^*| = \frac{1}{d_{010}}$$





Recip.
lattice



Rotate real lattice $\Rightarrow$ rotate reciprocal lattice

Bragg law : $\lambda = 2d \sin \theta_B$

TEM diffraction -

what is sca. angle measured? $2\theta_B$

$$2 \sin \theta_B = \frac{\lambda}{d}$$

$$\lambda \sim 2 - 2.5 \text{ nm}$$

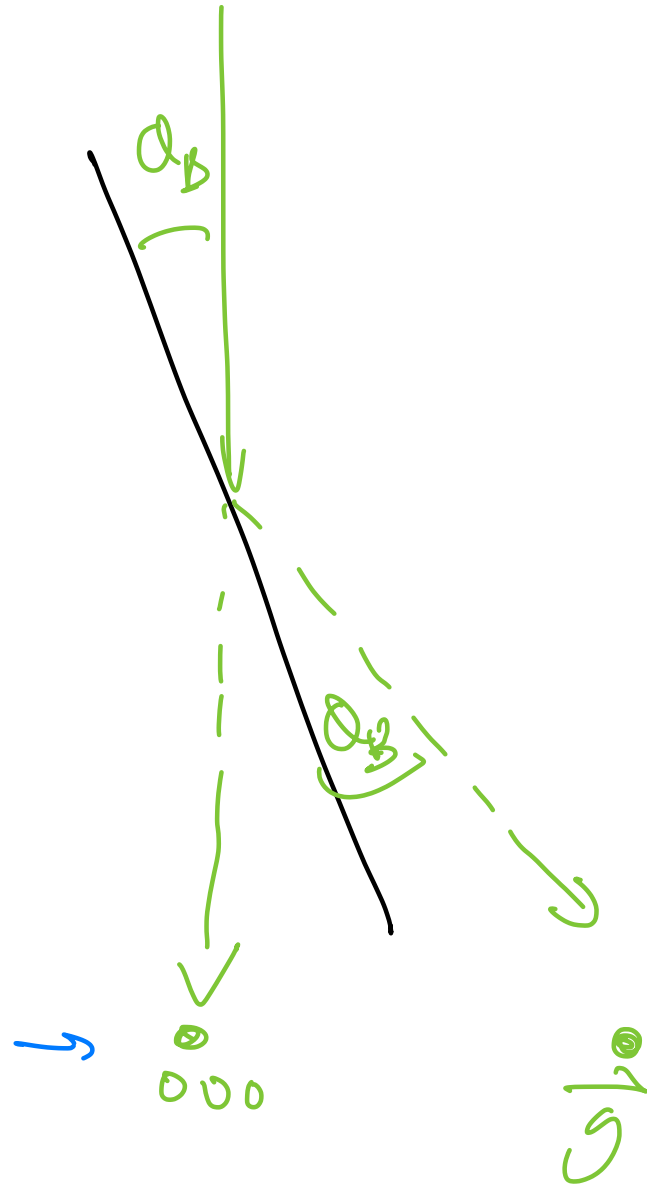
$$d_{hkl} \sim 1 \text{ nm} \sim 100 \text{ pm}$$

$$\Rightarrow d \gg \lambda$$

$$\Rightarrow \sin \theta_B \simeq \theta_B$$

$$\Rightarrow 2\theta_B \simeq \frac{\lambda}{d} \ll \frac{1}{d}$$

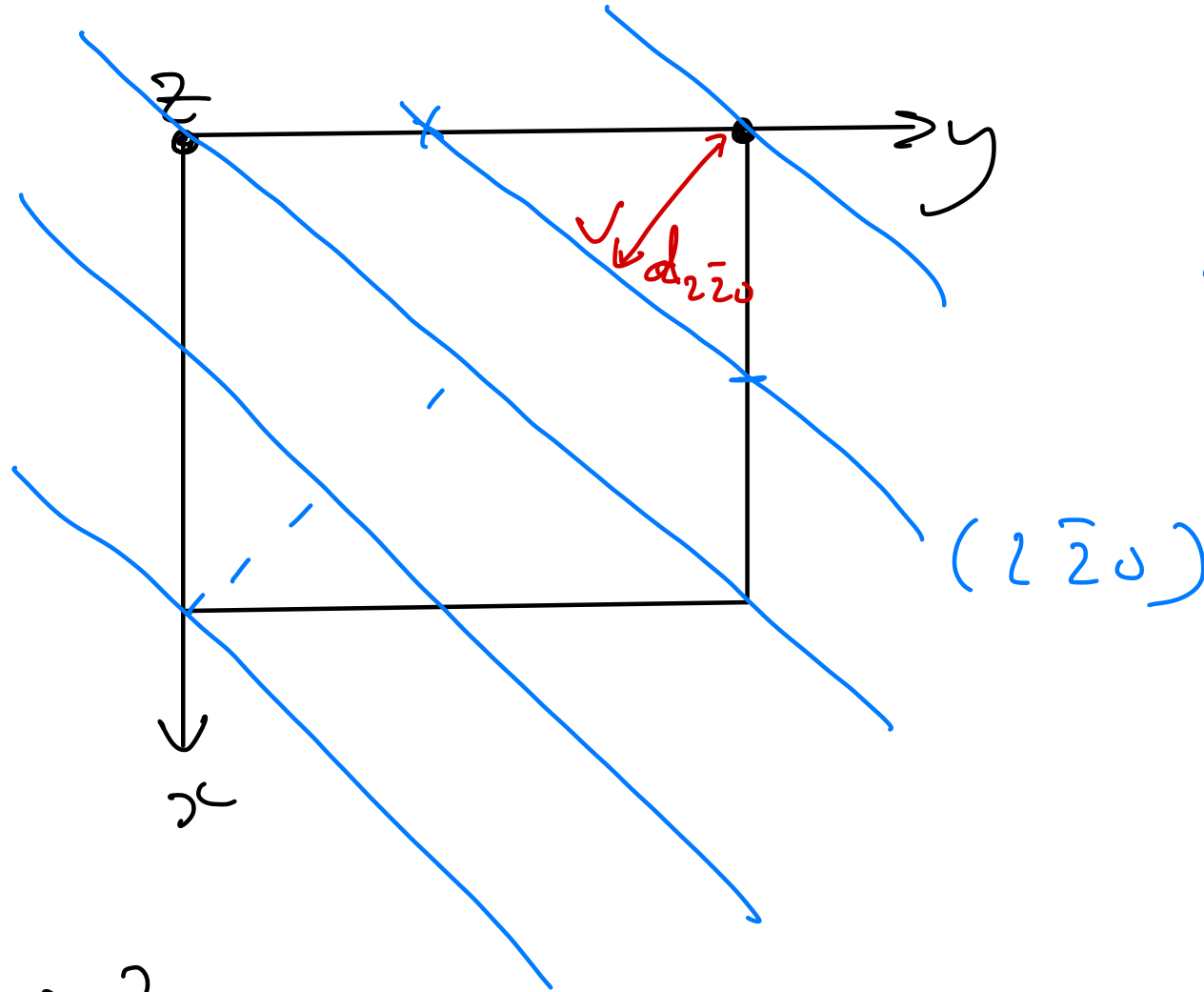
Direct
beam



$$\lambda_{200} : 2.51 \text{ \AA}$$

$$\lambda_{300} : 1.97 \text{ \AA}$$

$(2\bar{2}0)$



$$d_{2\bar{2}0} = \frac{\sqrt{2}a}{4}$$

$$= \frac{a}{2\sqrt{2}}$$

FCC: (100) ?