

LECTURE # 12

Note Title

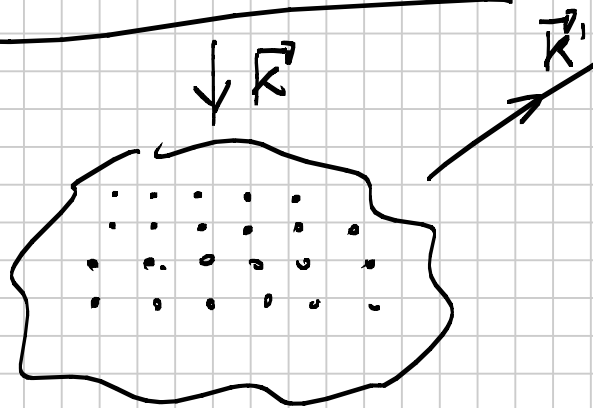
10/17/2007

HW 3 ONLINE DUE Oct 31

LAST TIME :

Reciprocal Lattice

\mathbf{K}_J



\vec{R}_i

$$e^{i\vec{K}_J \cdot \vec{R}_i} = 1 \quad \forall \vec{R}_i$$

Condition for constructive interference from ALL atoms

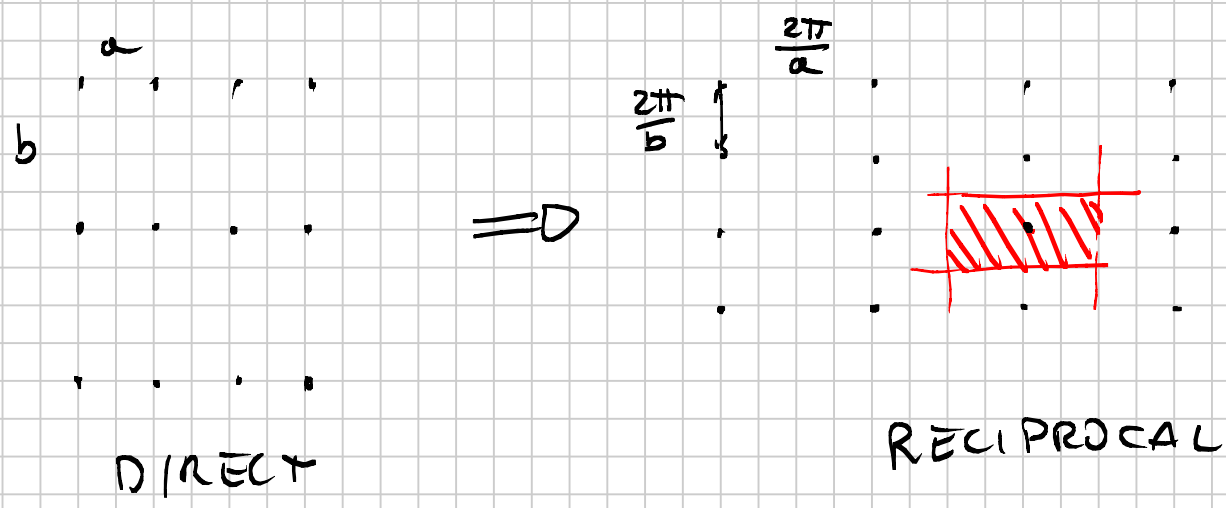
is

$$\vec{R}_i \cdot (\vec{k} - \vec{k}') = 2\pi m \quad \forall \vec{R}_i$$

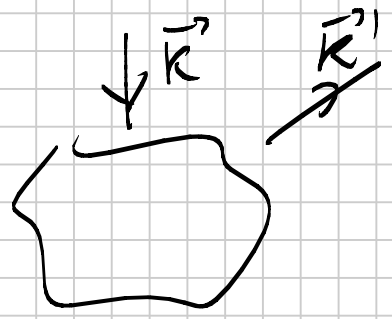
$$e^{i\vec{R}_i \cdot (\vec{k} - \vec{k}')} = 1 \quad \Leftrightarrow \quad \vec{k} - \vec{k}' = \vec{K}_J$$

1^o BRILLOUIN ZONE

= WIGNER-SEITZ
FOR REC LATTICE



BRAGG PLANE



$$\vec{k} - \vec{k}' = \vec{K}$$

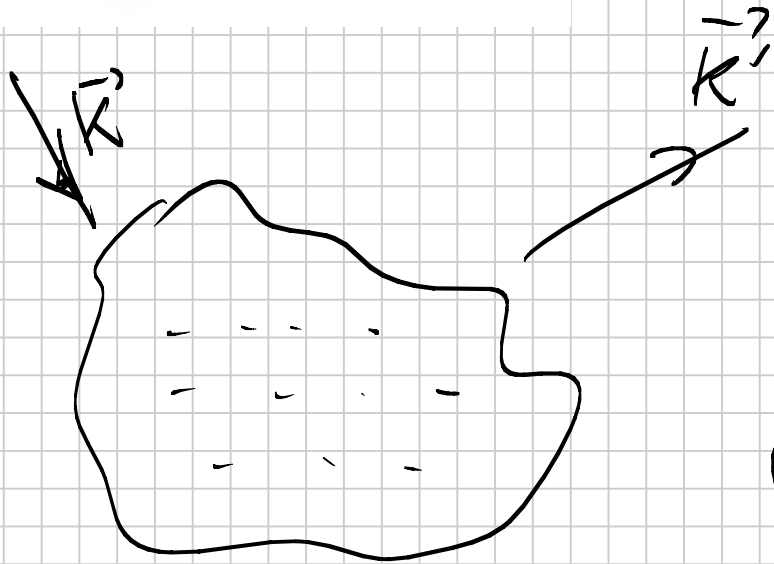
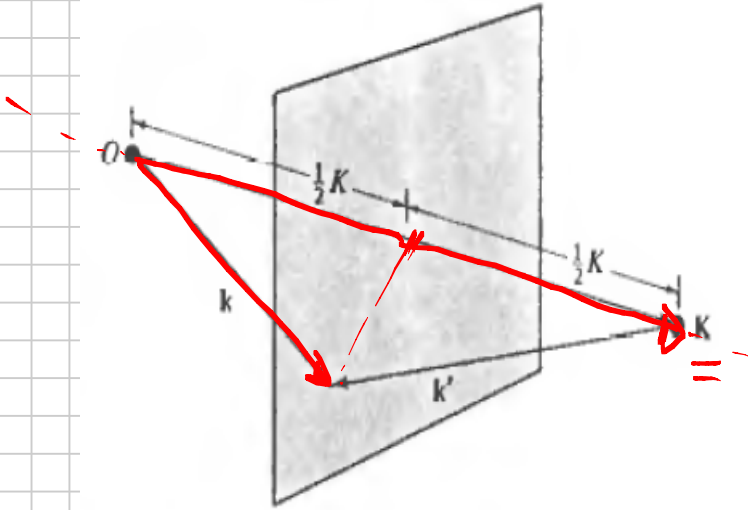
$$\vec{k}' = \vec{k} - \vec{K}$$

Scattering elastic $|\vec{k}| = |\vec{k}'|$

$$|\vec{k}'|^2 = |\vec{k}|^2 + |\vec{K}|^2 - 2 \vec{k} \cdot \vec{K} \Rightarrow$$

$$\vec{k} \cdot \vec{K} = \frac{|\vec{K}|^2}{2}$$

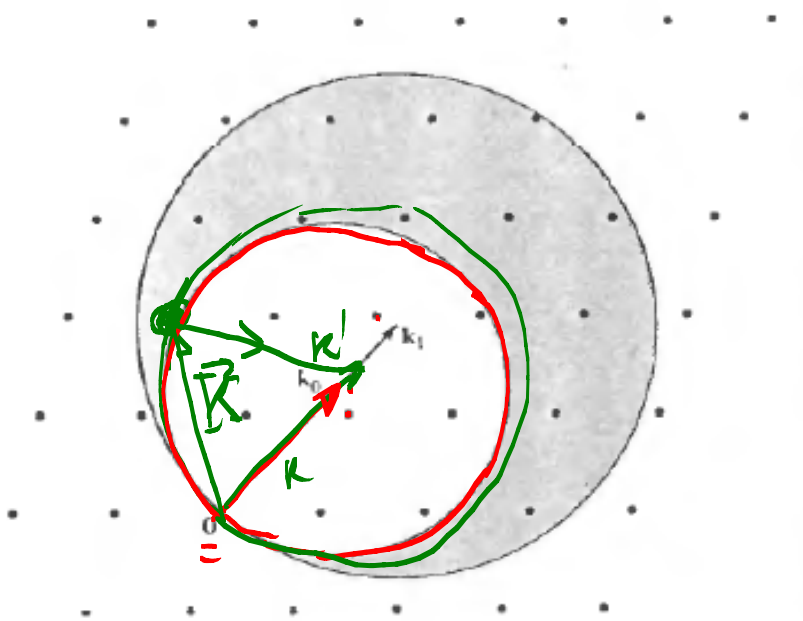
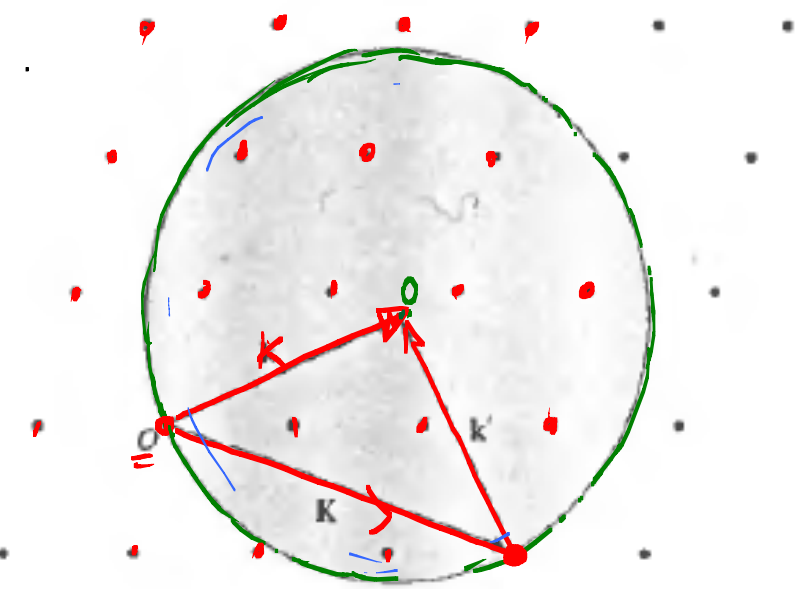
\vec{k}' will give a peak in scattering only if his tip is in a BRAGG PLANE



In general
No constructive
interference

- ① change $\lambda = \text{Change } |k|$
- ② change angle

RECIPROCAL LATTICE



EWALD'S
CONSTRUCTION

$$\vec{K} = \vec{R} - \vec{R}'$$

I change $|K|$

$|K_0| \rightarrow$ NO RC POINTS
ON EWALD'S
SPHERE

DECREASE λ

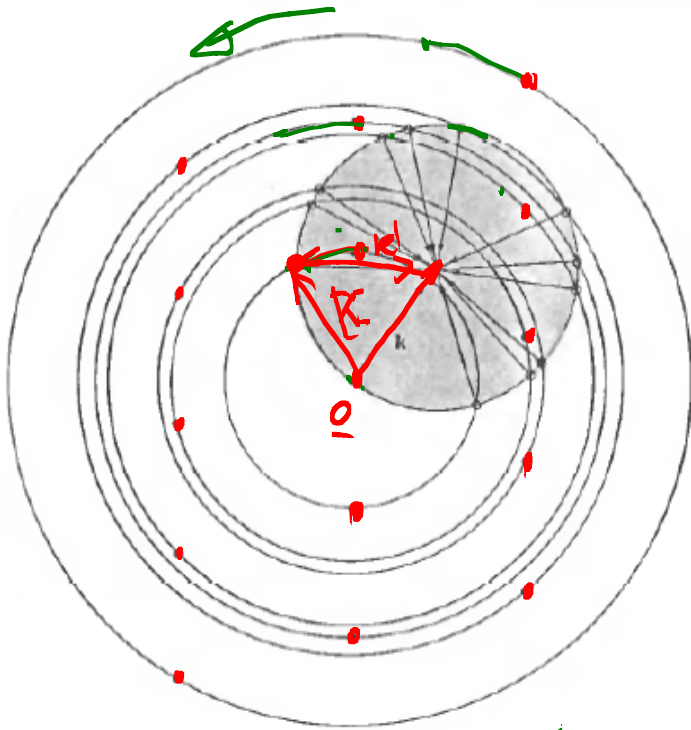
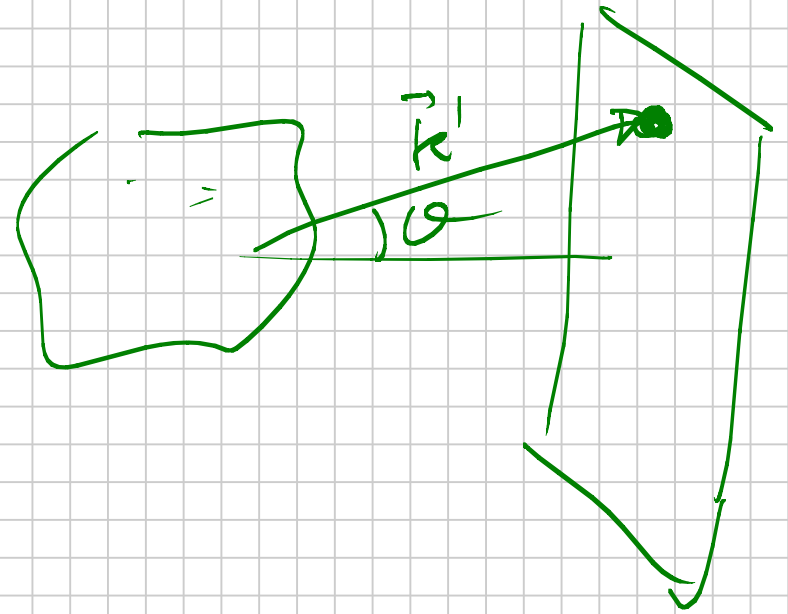
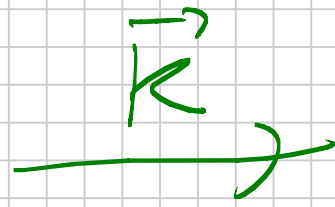
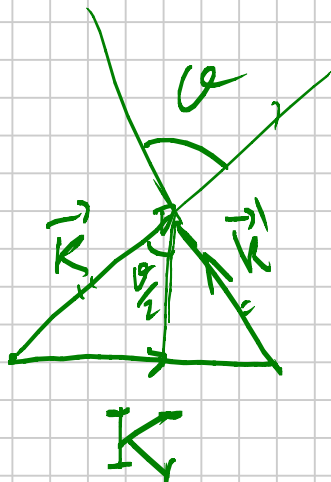
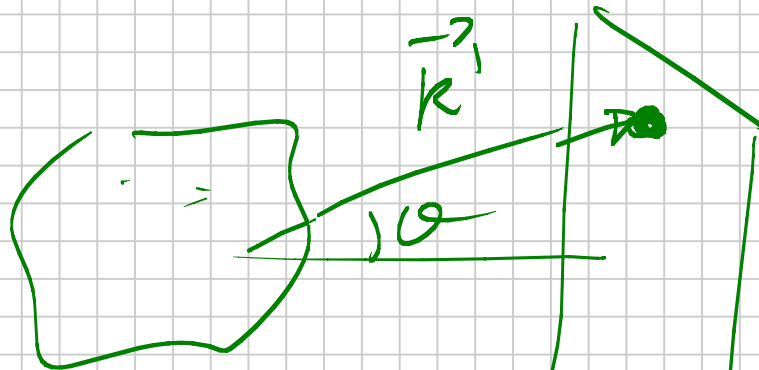


Figure 6.9



$$|\vec{K}'| \sin \frac{\varphi}{2} = \frac{|\vec{K}|}{2}$$

Debye-Sherrer method

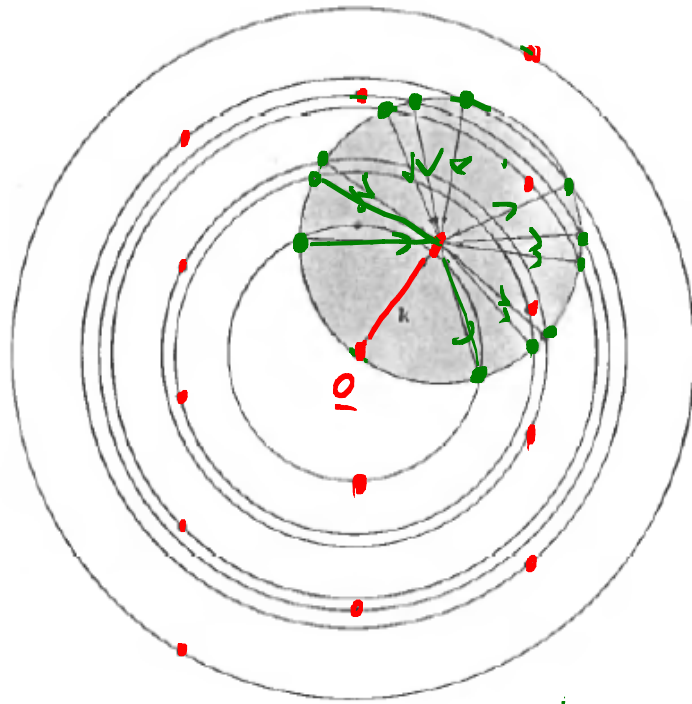


Figure 6.9

POWDER
(POLYCRYSTALLINE)
SAMPLE

SUM ALL ROTATION

12 possible \vec{k}'

