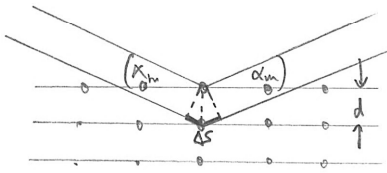
Modern Physics WS 21/22 — Sören Berling

Problem Sheet 12

Ex. 12.1:

a) constructive interference for Bragg scattering: $m \cdot \lambda = 2d \sin \alpha_m$, $m \in \mathbb{Z}$

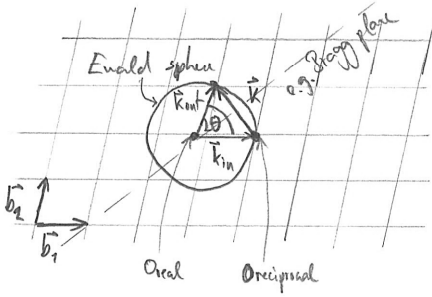


b) Laue condition for constructive interference:

$(\vec{k} - \vec{k}') \vec{R} = 2\pi n$, $n \in \mathbb{Z}$ — $\vec{R}$ vector of Bravais lattice

or

$(\vec{k} - \vec{k}') = \vec{K}$ — $\vec{K}$ vector of reciprocal lattice



c) as calculated in Ex. 11.3:

$$\vec{b}_1 = \frac{2\pi}{V_{cell}} (\vec{a}_2 \times \vec{a}_3)$$
$$\vec{b}_2 = \frac{2\pi}{V_{cell}} (\vec{a}_3 \times \vec{a}_1)$$
$$\vec{b}_3 = \frac{2\pi}{V_{cell}} (\vec{a}_1 \times \vec{a}_2)$$

$$V_{cell} = \vec{a}_1 (\vec{a}_2 \times \vec{a}_3)$$

d) The vectors of the reciprocal lattice form the normal vectors of the Bragg planes. The Bragg planes intersect the reciprocal lattice vector in the middle.

Ex. 12.2: Binding Types

a) chlorine (Cl_2) forms diatomic molecule due to covalent bonds, $Cl = [Ne]\, 3s^2\, 3p^5$

Below T = 172 K Cl_2 molecules crystallize into orthorhombic lattice due to Van-der-Waals force

b) potassium (K) below 336 K (63 °C) a metal with bcc lattice $K = [Ar]\, 4s^1$

c) potassiumchloride (KCl) forms ionic bond. Below T = 1046 K (773 °C) a cubic crystal.

Ex. 12.3: Problem Sheet 10 - "Mock Exam"

- Problem 10.1

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- Problem 10.2