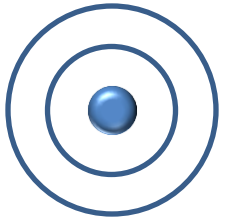
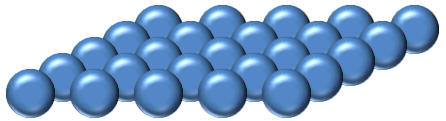
Bottom-Up Approach

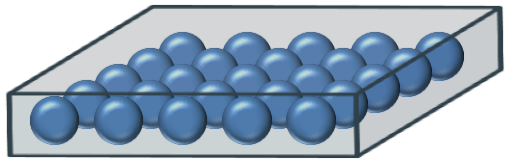
- Scattering of an atom



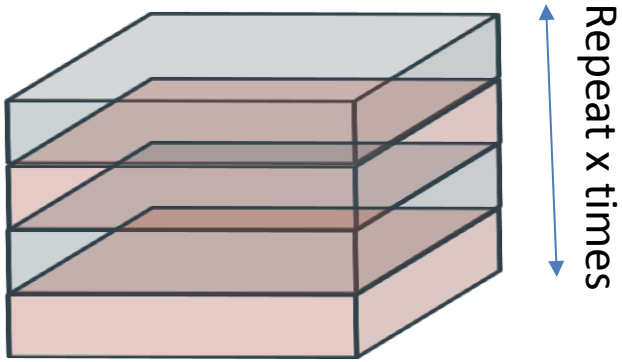
- Scattering of a plane of atoms



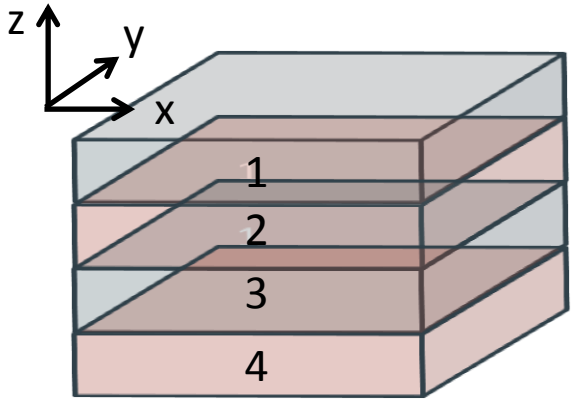
- Scattering by a slab



- Scattering of a thin film



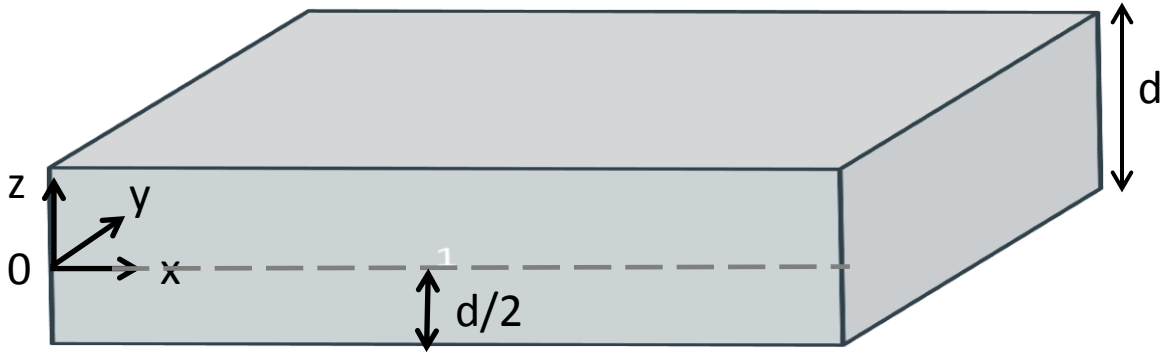
Coordinate system and numbering of layers



Incoming light

$$\vec{k} = k_0 \begin{pmatrix} \sin\theta\cos\phi \\ \sin\theta\sin\phi \\ \cos\theta \end{pmatrix}$$

Definition of a slab



Definitions

Plane wave: $\vec{E} = E_0 \vec{\varepsilon} \cdot e^{i\vec{k}\vec{r} - i\omega t}$

Momentum transfer: $\vec{q} = \vec{k}_{in} - \vec{k}_{out}$

Reciprocal lattice vector: $\vec{g} = h \cdot \vec{b}_1 + k \cdot \vec{b}_2 + l \cdot \vec{b}_3$

The vectors b are the reciprocal lattice vectors

Scattered wave in 3 dimensions: $\vec{k}_{out} = \vec{k}_{in} + \vec{g}$ (common definition)

Scattered wave for 2 dimensional lattice : (program definition)

$$\vec{k}_{out} = \begin{pmatrix} k_{inx} + g_x \\ k_{iny} + g_y \\ \pm\sqrt{{k_0}^2 - (k_{inx} + g_x)^2 - \left(k_{iny} + g_y\right)^2} \end{pmatrix}$$

Bragg Condition: $\vec{q} = -\vec{g}$

Structure factor: $\sum_i f_i \, e^{i\vec{q}\vec{r}_i}$