

Solid state Physics

⊆ Condensed Matter (solid + liq)

⊆ Study of all Matter

Crystals

Quasi
"Crystals"

Amorphous
Solids
(Glasses)

Liquids →
↳ superfluid

Solids

Colloids
Foams
Gels

→ Gas

Plasma

Superconductivity

Electron "Gas"

Phase
Transitions

Crystals

Why study? Simple,
Common, Interesting Electrical
Properties.

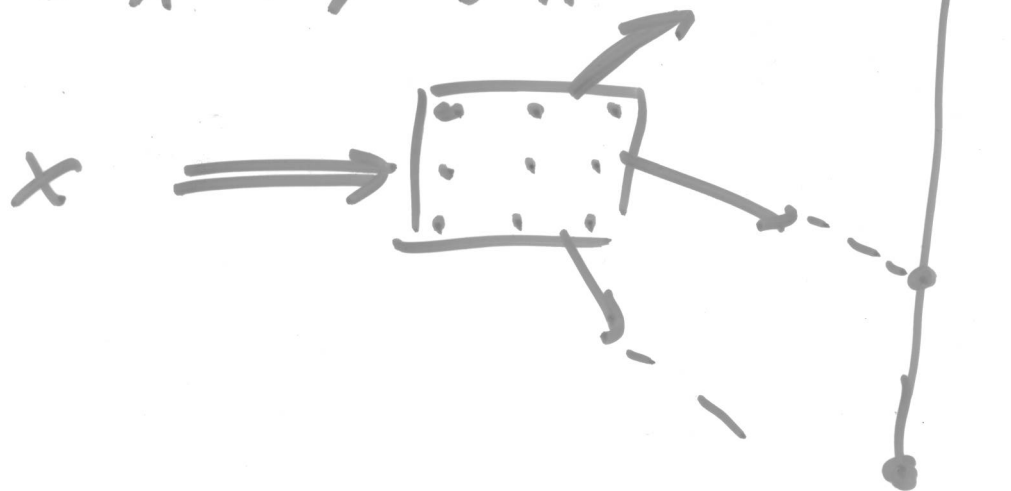
Evidence for crystals.

→ Miller indices for cleavage
planes always integers

e.g. (3, 5, 14)

never $(\sqrt{2}, 1, \pi)$...

→ X-ray Diffraction



14 Bravais Lattices

7 Lattice Systems \times 4 centering

Point Group - symmetry that leaves one lattice site fixed
rotations & reflections

e.g. Two dimensions

Rotations by: $360^\circ, 180^\circ, 120^\circ, 90^\circ, 60^\circ$

C_1, C_2, C_3, C_4, C_6
Include Reflections
 D_1, D_2, D_3, D_4, D_6 } 10 point groups

In Three dimensions \rightarrow 32 point groups

Space group

Bravais Lattice \times Point groups

e.g. 3 dimensions

$$14 \times 32 = 448 \times$$

In fact there are only
230 space group elements

Two dimensions

5 Bravais Lattices \times 10 point group

$$= 50 \times$$

only 17 wallpaper patterns

\wedge # space groups