



TRINITY COLLEGE FOR WOMEN NAMAKKAL

Department of Physics

Solid state physics

19UPHE01-ODD Semester

Presented by

P.Sumathi,

Assistant Professor,

Department of Physics,

<http://www.trinitycollegenkl.edu.in/>

What is a crystal?

□ Historic definition before the advent of crystallography -

A solid with well-defined faces

□ Crystallographic definition –

A material with a regularly repeating structural motif

□ The strict definition is more vague

–

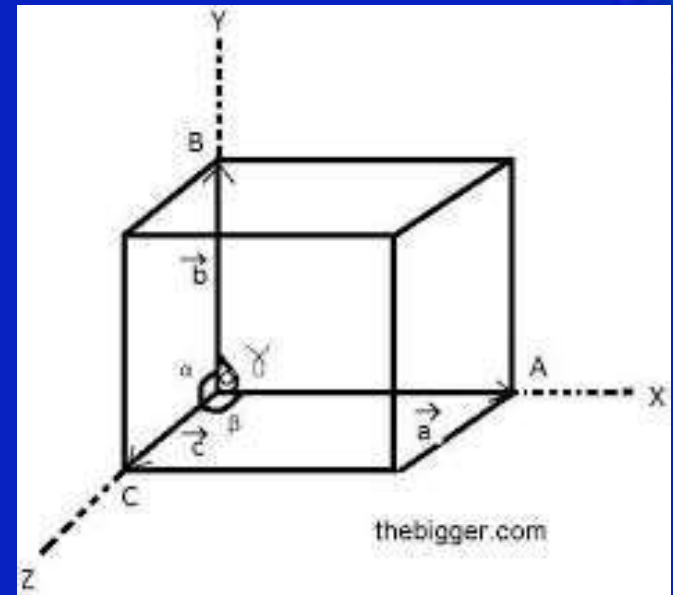
Any material that gives a diffraction pattern with sharp peaks

The unit cell

➤ The repeating structural motif in a crystal is referred to as a unit cell –

Only the size and contents of one unit cell are necessary to describe the entire crystal

➤ Remember to use a right-handed axis system!

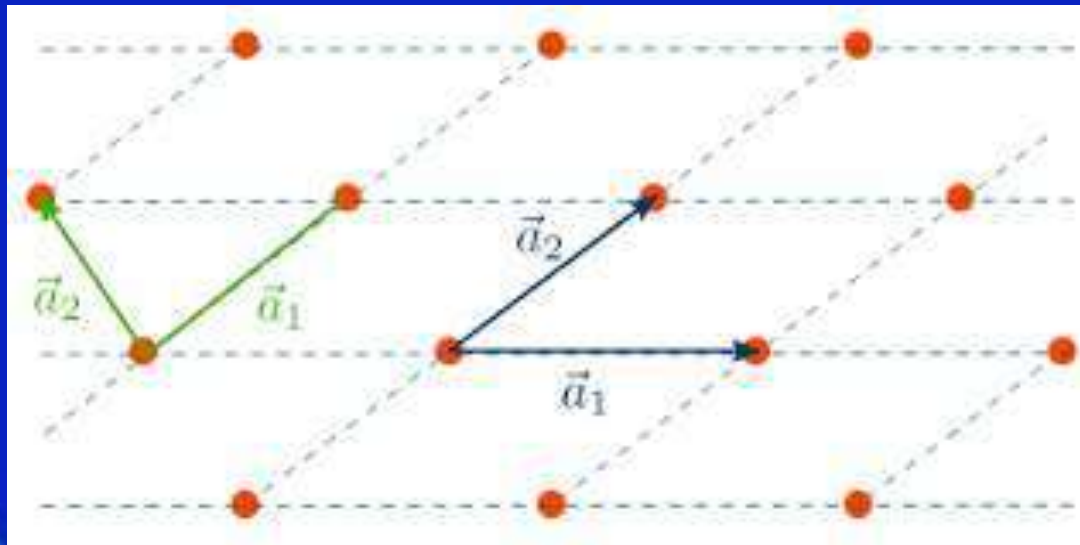


Types of Crystal Lattice

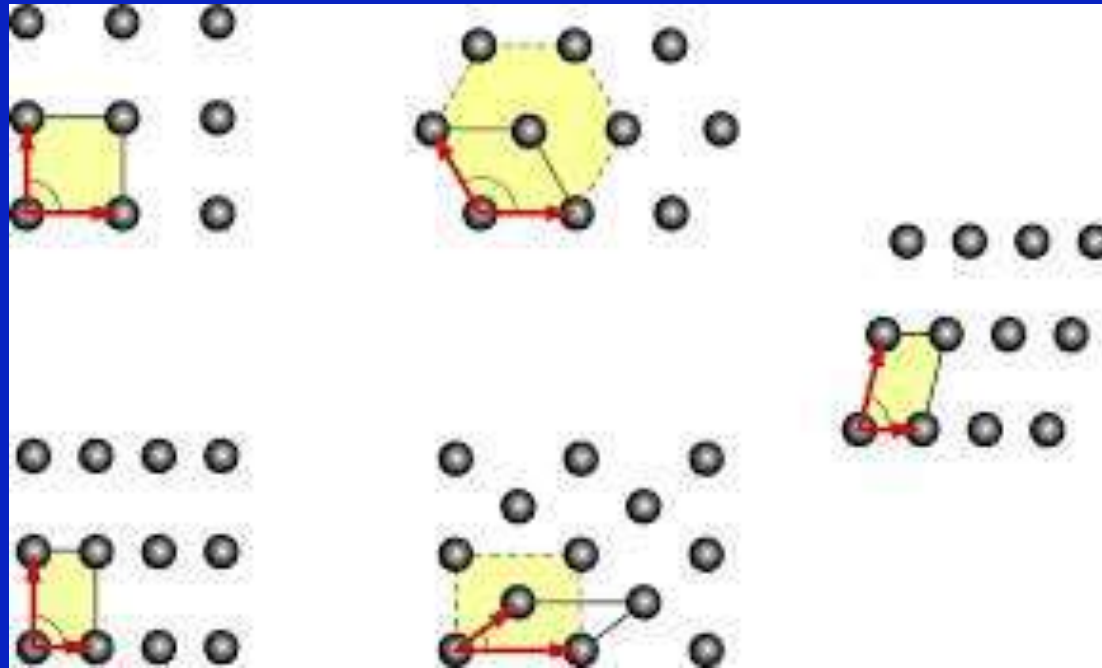
Two Dimensional Lattice Type:

consider two lattice vectors for defining any point. The simplest translational T can be given as

$$T = na_1 + ma_2$$



Five distinct type of lattice in two dimensions called Bravais lattice.



Five distinct types of Bravais

Lattice: square,

rectangular, hexagonal, centered

Sr. No.	Crystal System	Axial length of Unit Cell	Inter axial angles	Number of Lattice in the system
1	Cubic	$a = b = c$	$\alpha = \beta = \gamma = 90^\circ$	3
2	Tetragonal	$a = b \neq c$	$\alpha = \beta = \gamma = 90^\circ$	2
3	Orthorhombic	$a \neq b \neq c$	$\alpha = \beta = \gamma = 90^\circ$	4
4	Monoclinic	$a \neq b \neq c$	$\alpha = \beta = 90^\circ \neq \gamma$	2
5	Triclinic	$a \neq b \neq c$	$\alpha \neq \beta \neq \gamma \neq 90^\circ$	1
6	Trigonal	$a = b = c$	$\alpha = \beta = \gamma < 120^\circ, \neq 90^\circ$	1
7	Hexagonal	$a = b \neq c$	$\alpha = \beta = 90^\circ, \text{ and } \gamma = 120^\circ$	1

Cubic crystal system

- *The simplest and easiest structure.*
- *Three types of possible crystal structure under this family named as simple cubic, body centered cubic and face centered cubic.*

Simple cubic crystal (sc)

- Lattice points are arranged at each 8 corner of cube.
- At each corner of cube, an atom is shared by 8 nearby unit cells.
- Example Cu, Ag, Au are this types of structure

Body centred cubic(BCC):

Body-centered cubic (BCC) is the name given **to a type of atom arrangement found in nature**

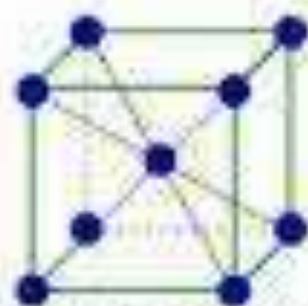
Face centred cubic (FCC):

Face-centered cubic (FCC or cF) is the name given **to a type of atom arrangement found in nature**

Crystalline structure

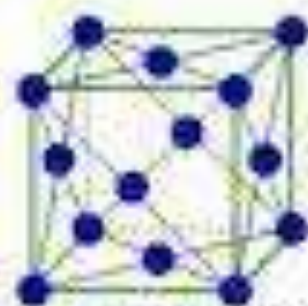
Crystal lattice examples

Unit cells



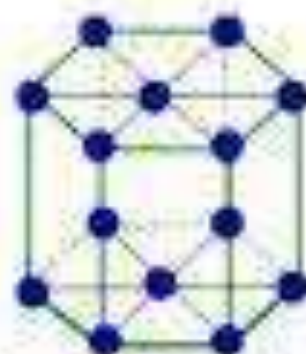
Cubic body centered (bcc)

Fe, V, Nb, Cr



Cubic face centered (fcc)

Al, Ni, Ag, Cu, Au



Hexagonal

Tl, Zn, Mg, Cd



BCC



FCC



HCP

Allotropic characteristics?

THANK YOU

<http://www.trinitycollegenkl.edu.in/>