LECTURE #9

BRAVAIS LATTICES

ARRANGEMENT OF ATOMS IN SPACE WITH THE FOLLOWING PROPERTIES

1. SAME "VIEW" WHEN MOVE FROM ONE ATOM TO A DIFFERENT ONE

2. \[ \mathbf{R}^0 = m_1 \mathbf{a}_1 + m_2 \mathbf{a}_2 + m_3 \mathbf{a}_3 \]

\[ m_1, m_2, m_3 \in \mathbb{Z} \] (INTER)

\[ \mathbf{a}_1, \mathbf{a}_2, \mathbf{a}_3 \] 3 NON PARALLEL \text{ PRIMITIVE VECTORS} \text{ (IN GENERAL)}
2D

Not a Bravais lattice

3D

Cubic

Body centered cubic

Face centered cubic

BCC
PRIMITIVE UNIT CELL

PRIMITIVE UNIT CELL

1 ATOM / UNIT CELL

"DENSITY" = \frac{1}{\text{AREA OF UNIT CELL}}

WIGNER-SEITZ CELL = UNIT CELL WITH ATOM AT THE CENTER

"VORONOI" PARTITION OF SPACE
WS cell for BCC

Truncated octahedron

WS for Fcc

Rhombic dodecahedron
LATTICE WITH BASIS

- BRAVAIS A
- BRAVAIS B

PRIMITIVE VECTORS

\[ \vec{a}_1, \vec{a}_2 \]

- \[ \vec{b}_A = 0 \]
- \[ \vec{b}_B = (a_1, 0) \]

\[ \vec{a}_1, \vec{a}_2, \vec{a}_3 \] FCC

- \[ \vec{b}_A = 0 \]
- \[ \vec{b}_B = \frac{a}{4} (1, 1, 1) \]

C - Si, -Ge
GaAs

A → Ga
B → As

\{ Zinc Blend Lattice \}

( \text{ZnS} \}

\text{Hexagonal Lattice}

\text{Hexagonal Lattice 3D}

\text{Bravais}

\text{Bravais
HEXAGONAL CLOSED PACKED HCP

\[ \mathbf{b}_A = \mathbf{0} \]

\[ \mathbf{b}_B = \frac{\mathbf{a}_1}{3} + \frac{\mathbf{a}_2}{3} + \frac{\mathbf{a}_3}{2} \]