LECTURE # 11

BRAVAIS LATTICE

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

PRIMITIVE VECTORS

\[ \mathbf{a}_1 \]
\[ \mathbf{a}_2 \]
\[ \mathbf{a}_3 \]

PRIMITIVE UNIT CELL

ONLY 1 ATOM PER UNIT CELL

\[ M (\text{density of atoms}) = \frac{1}{\text{AREA (of unit cell)}} \]
Wigner-Seitz cell

A x G Wigner-Seitz unit cell

The closest atom is the one at the center of the cell

BCC WS cell = truncated octahedron
FCC
TRUNCATED DODECAHEDRON
12 NEIGHBORS

HONEYCOMB LATTICE
LATTICE WITH A BASIS
Take A and B together

Lattice with a basis

Crystal structure with \( \vec{a}_1 \) and \( \vec{a}_2 \) as primitive vectors

with basis \( \vec{b}_A = 0 \) \( \vec{b}_B = (a, 0) \)
$\begin{align*}
\mathbf{a}_1 &= \frac{a}{2} (110) \\
\mathbf{a}_2 &= \frac{a}{2} (101) \\
\mathbf{a}_3 &= \frac{a}{2} (011) \\
\mathbf{b}_0 &= 0 \\
\mathbf{b}_1 &= \frac{a}{4} (111)
\end{align*}$

C, Si, Ge

GaAs, CdTe

ZINC BLEND
1. Base centered cubic
2. Side-centered cubic
3. Edge centered cubic

Questions:
1. Bravais lattice?
2. Basis?
3. Density?