Day 2 pg 1

Prayer, Survey - post notes on website? Comment - reading assignments

handouts for Yangping

demo request
Stokes crystal models

Vocabulary review (call on students)

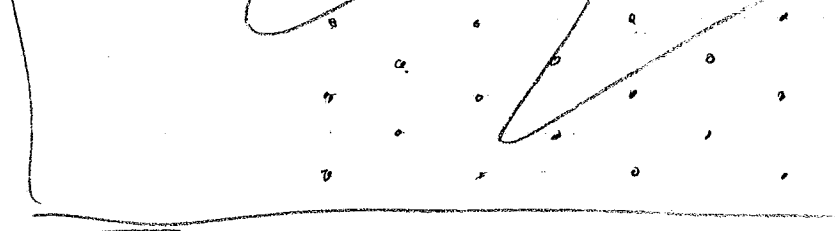
crystal
lattice (14 Bravais lattice)
lattice vectors
primitive lattice vectors
unit cell
primitive unit cell
Wigner-Seitz cell → forgot to mention this (see day 1 pg 3 notes)
conventional unit cell
basis
symmetry operation
translation
point operations, or pt symmetries
rotation → forgot to mention notation C_{4x}^+, C_{3y}^-, etc
reflection ex σ_{xy}
combo ex $S_{...}$
inversion I
space group (230 space groups)
crystal class (32 classes)
sc
bcc
fcc

2D lattices, cont from last time

- why no centered square lattice? (see next page)
- why no pentagonal lattice? (see overhead No translational symmetry!)

2D cont

5) centered rectangular



rectangular, but with extra dot in middle of rectangles.

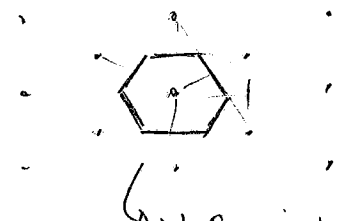
end of day 1

why not "centered square" type?

hey, it's just square! (rotated)

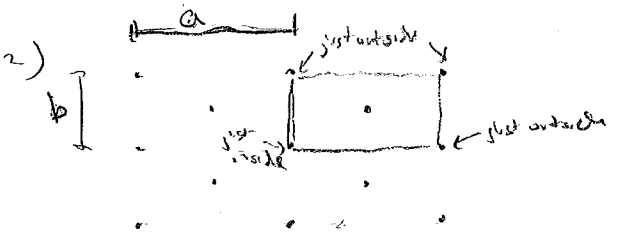
Two ways of looking at centered rectangular w/ 1 atom/cell

1)



↳ W-S primitive unit cell + 1 atom/cell

2)



rectangular unit cell (not primitive) + 2 atoms/cell

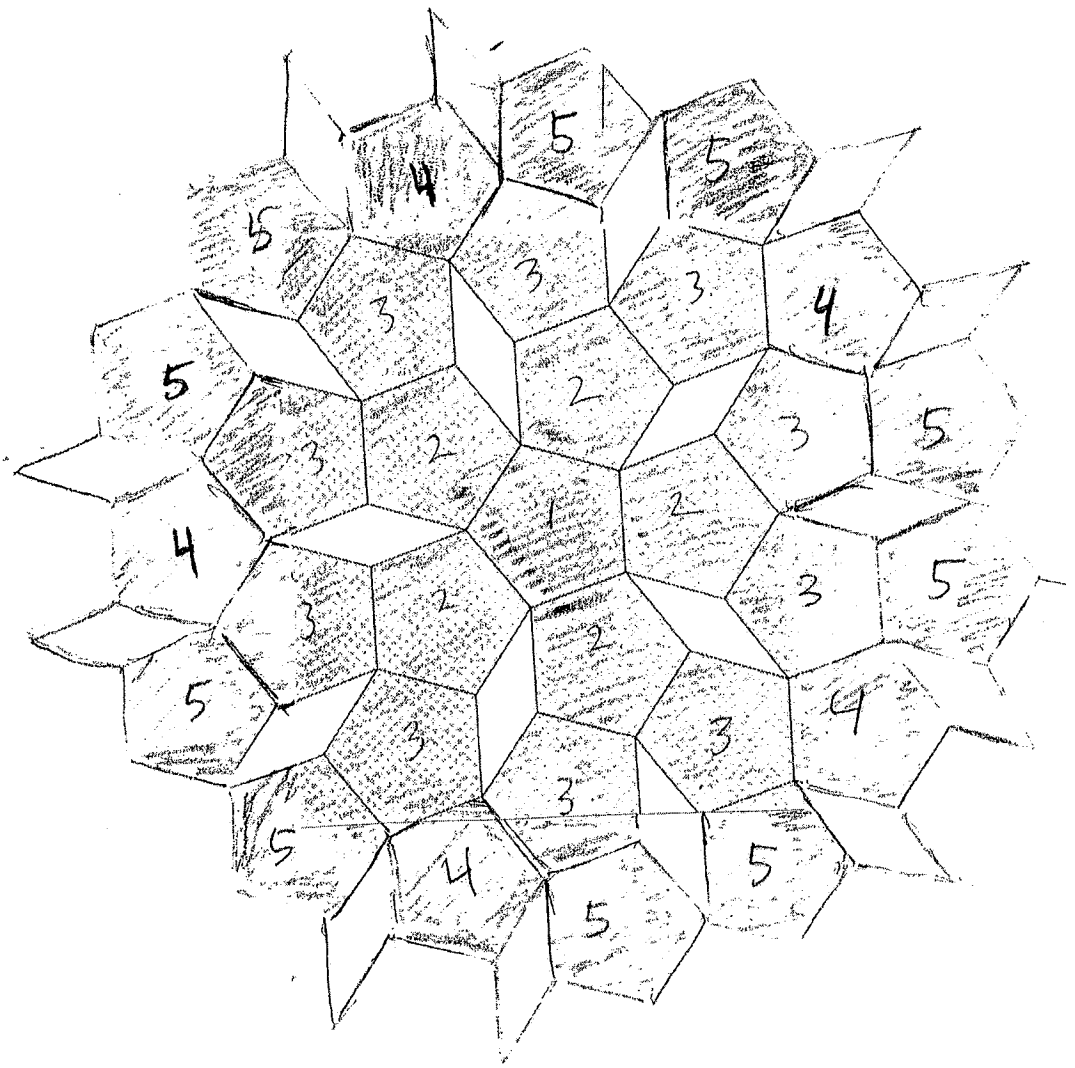
$\vec{r}_1 = (0,0)$

$\vec{r}_2 = (a/2, b/2)$ in this example.

which is easier?

Pentagonal Tiling of 2D Plane
Physics 581 Colton

From Kittel Fig. 1.5, pg 7



One more notation note: [ ] vs ( ) vs { }

[ ] a direction. Eg [100] = $\hat{x}$

[110] = $\frac{\hat{x}+\hat{y}}{\sqrt{2}}$

( ) a single plane or set of parallel planes "Miller indices"

Defined by intercepts on primitive l.v. lines

If plane intersects lines at: $A_1\vec{a}_1$, $A_2\vec{a}_2$, $A_3\vec{a}_3$

take inverse $\left(\frac{1}{A_1}, \frac{1}{A_2}, \frac{1}{A_3}\right)$

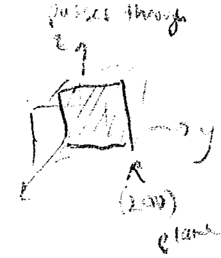
multiply by LCD

→ (h,k,l)

careful: for (simple) cubic the planes are exactly what you'd expect: (100) = ⊥ to [100] direction

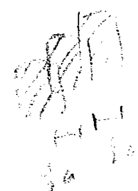
but not necessarily for other systems

(200) = ⊥, and passes through



Convention ~~xxxx~~ is based for sc cubic planes

If representing a set of planes, (200) =



{ } planes equivalent by symmetry

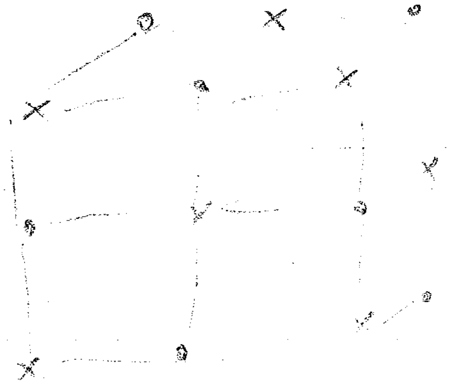
Ex. in s.c. {100} = (100), (010), and (001) planes

"bcc structure" vs "bcc lattice"

Some real materials! (finally)

Elements pg 20 ✱
✱ bcc : Li, Na, K, V, Cr, Fe, Rb, Nb, Mo, Cs, Ba, Ta, W, Eu
✱ fcc : Ne, Al, Ar, Ca, Ni, Cu, Kr, Sr, Rh, Pd, Ag, Xe, Ir, Pt, Au, Pb, Ac, Ce, Yb, Th

Sodium chloride



http://cst-www.nrl.navy.mil/lattice

also Stile's website

links at bottom of class website

Lattice = ? fcc, not sc

basis: Cl^- ion at 000
Na^+ ion at $\frac{1}{2}\frac{1}{2}\frac{1}{2}$

8 atoms in conventional unit cell

"NaCl structure" = name of this structure & also used by other crystals

book list: LiH, MgO, MnO, (NaCl), AgBr, PbS, KCl, KBr

Note 1:1 stoichiometry