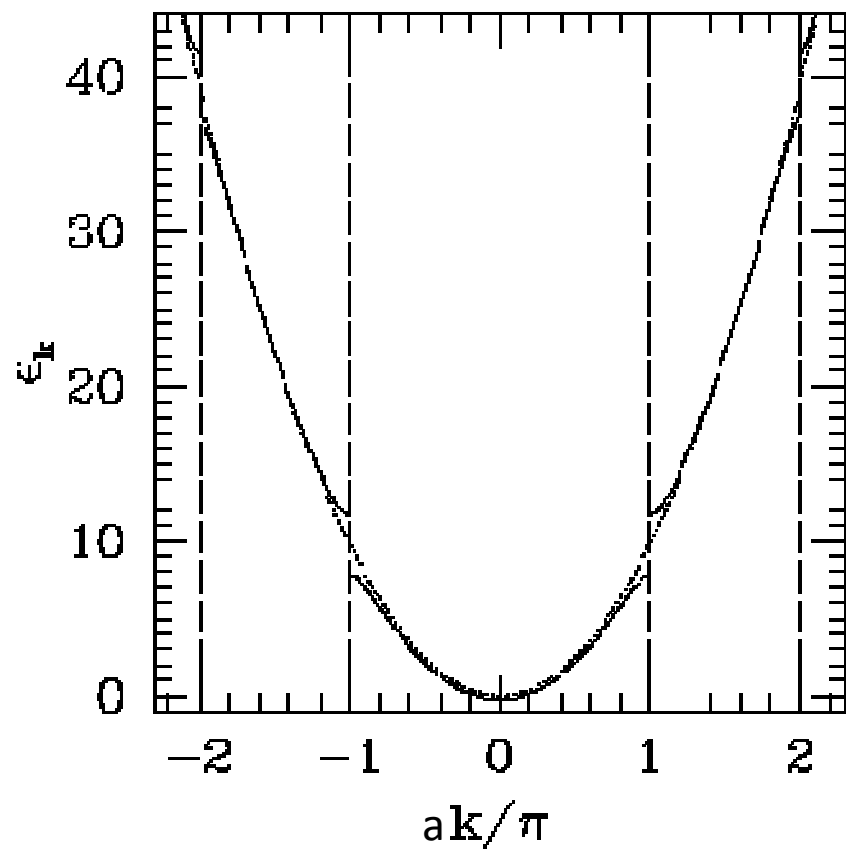
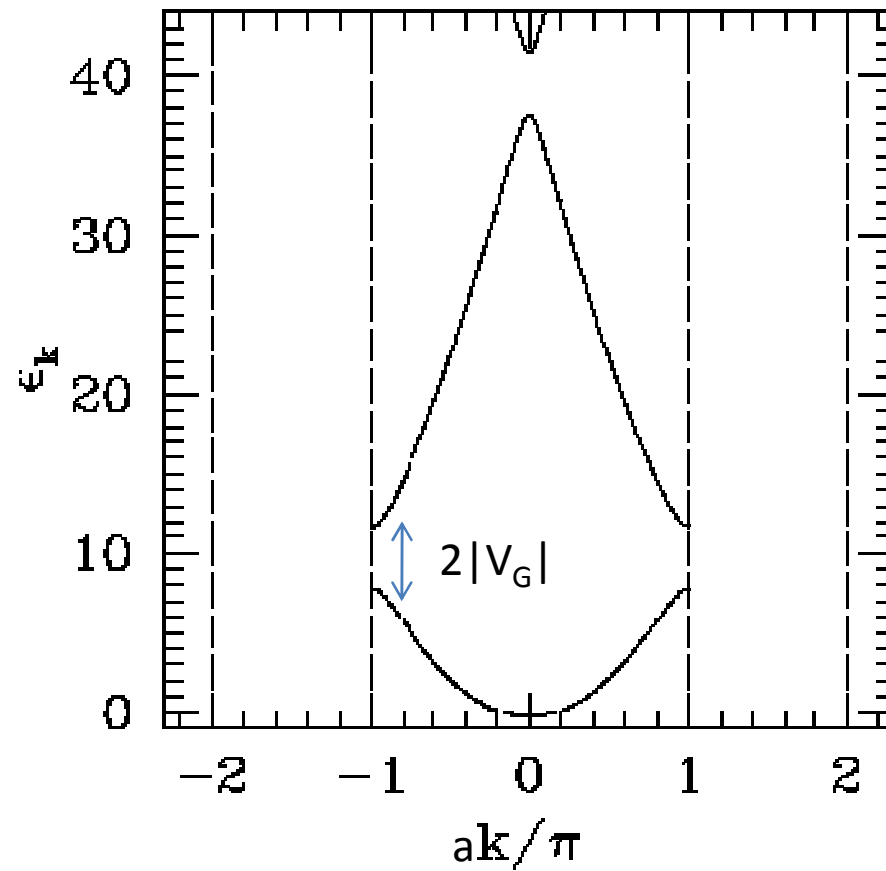


Slides
Condensed Matter Physics
Lecture 15

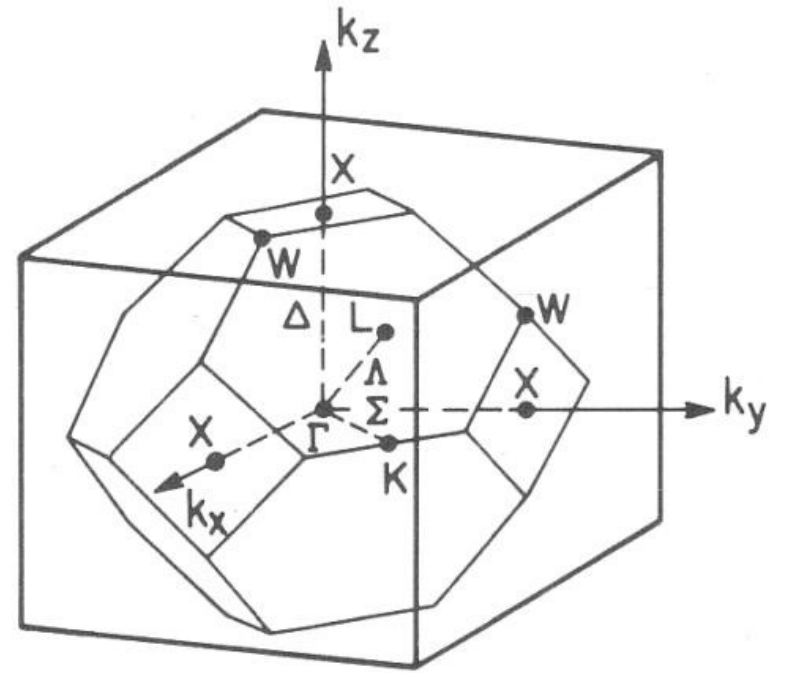
d=1 extended zone



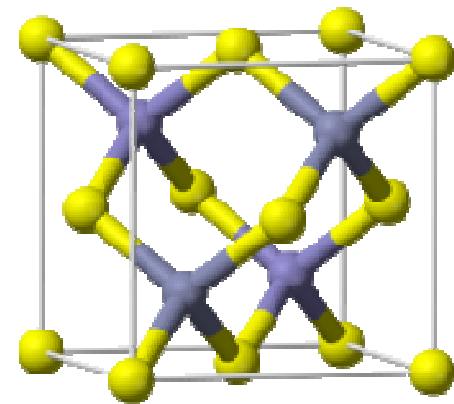
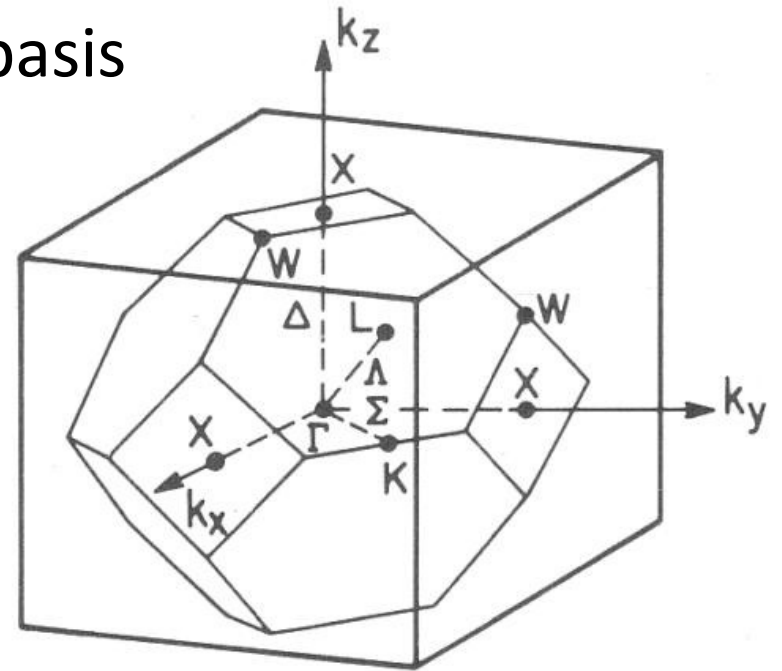
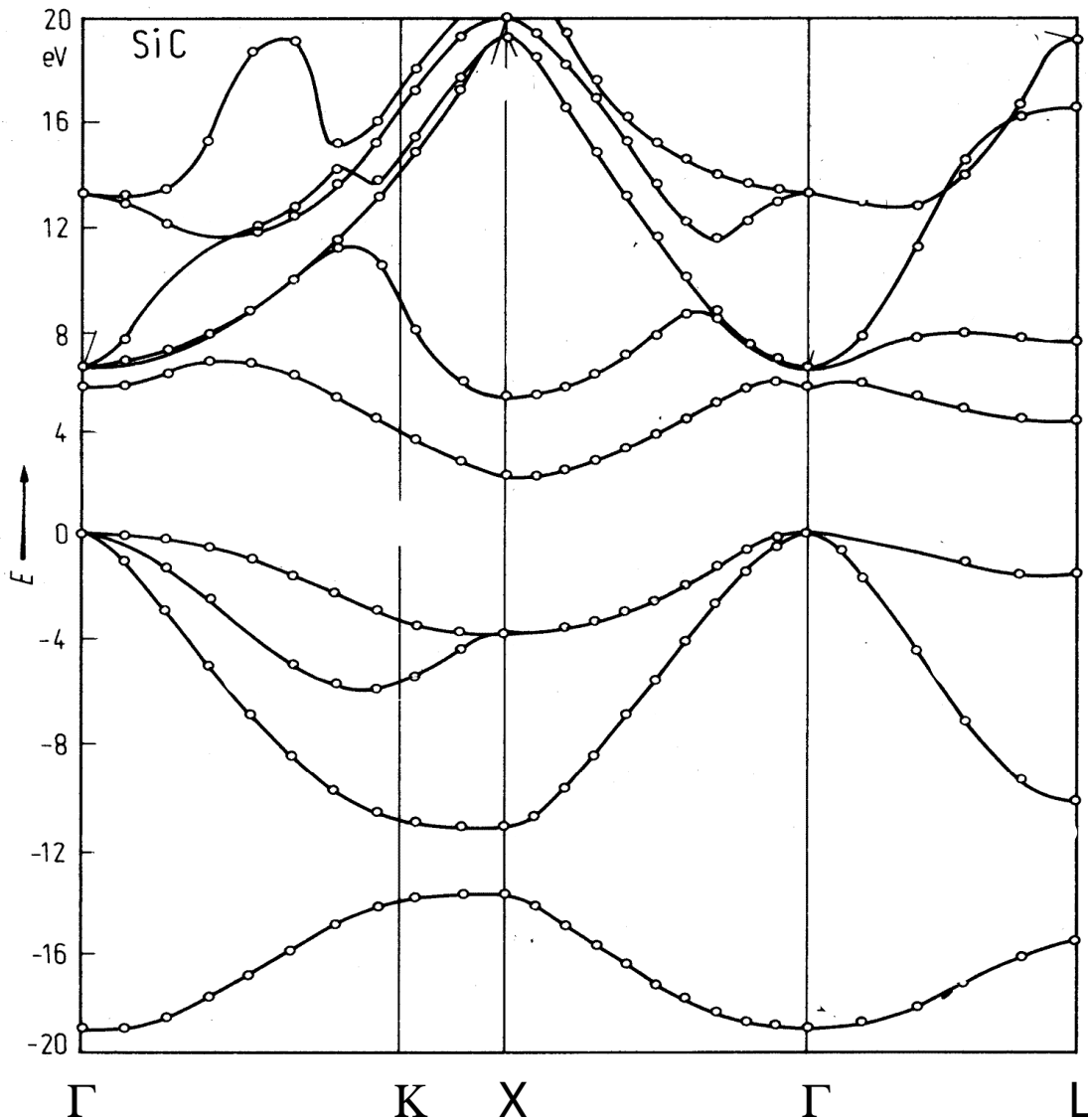
d=1 reduced zone



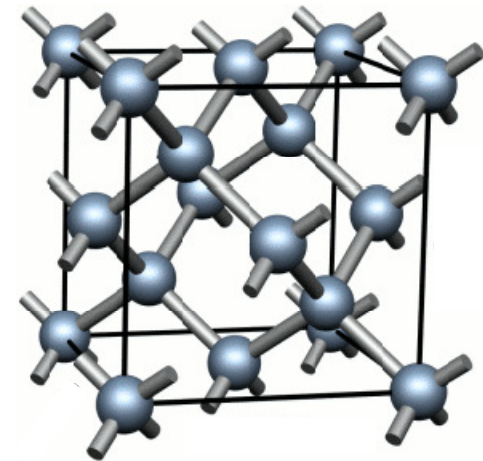
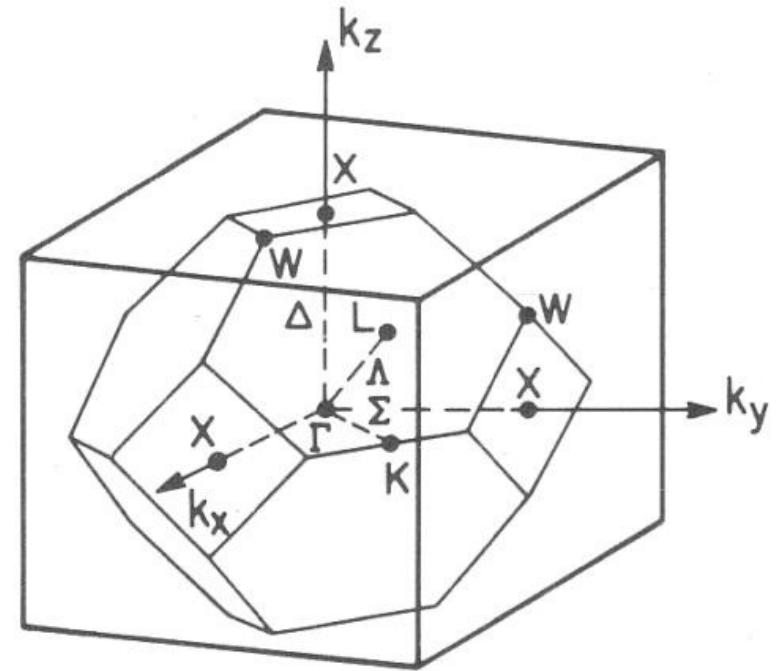
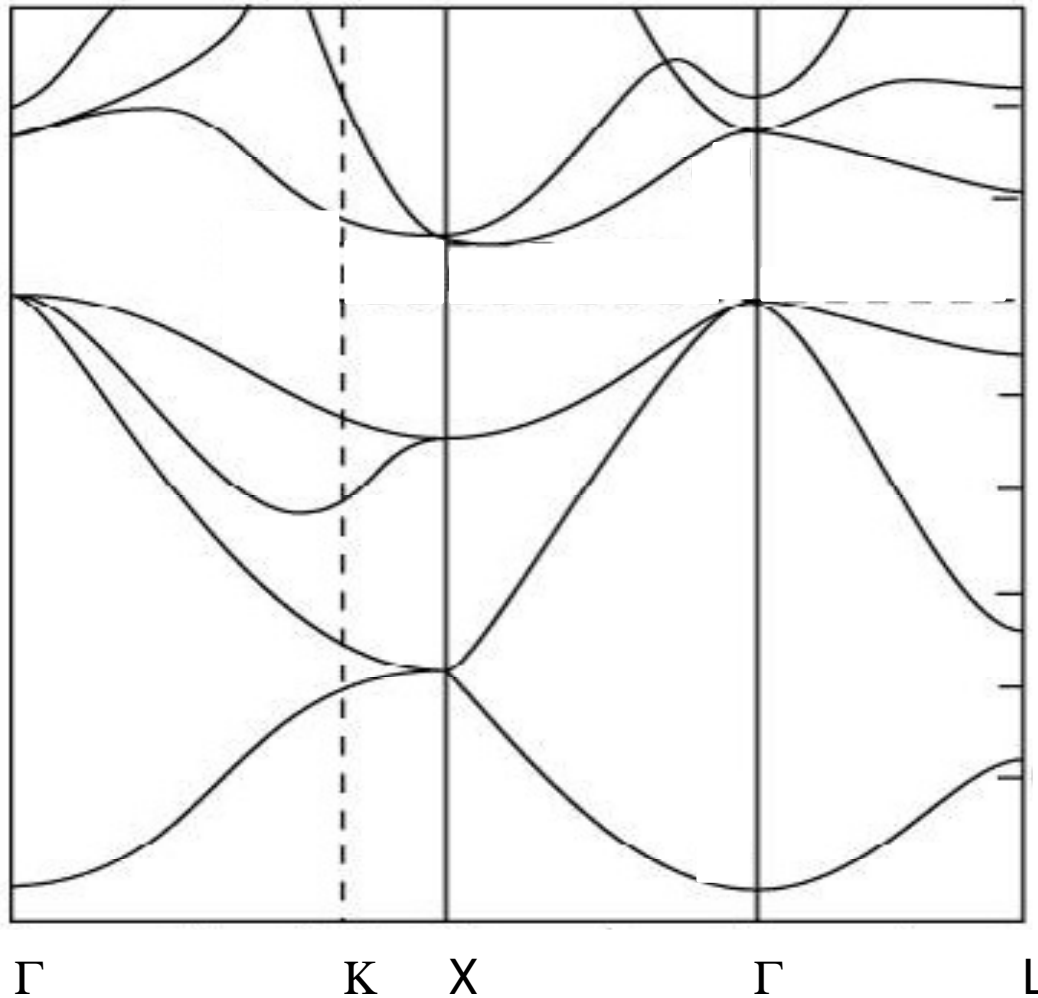
1st Brillouin Zone of an FCC lattice
=same shape as Wigner Seitz
cell of a BCC lattice



Silicon Carbide = FCC with a 2-atom basis
Si @ [0,0,0] and C @ [1/4, 1/4, 1/4]

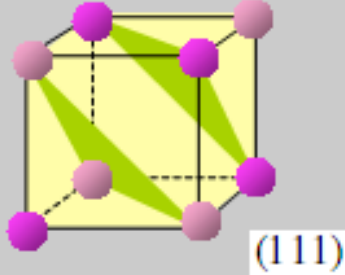
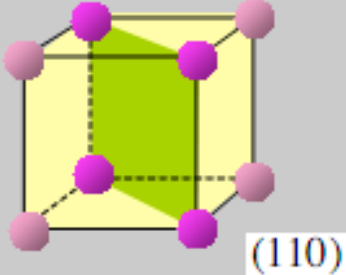
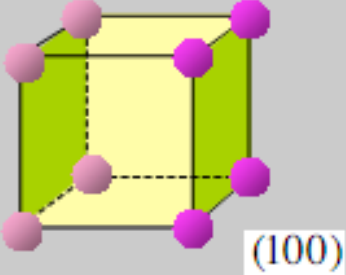


Silicon = FCC with a 2-atom basis
Si @ [0,0,0] and Si @ [1/4, 1/4, 1/4]

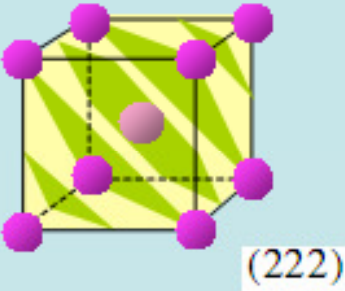
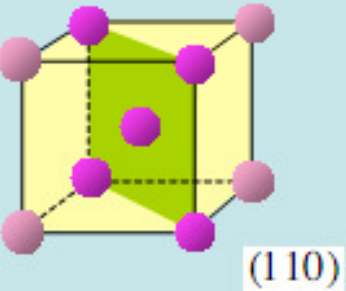
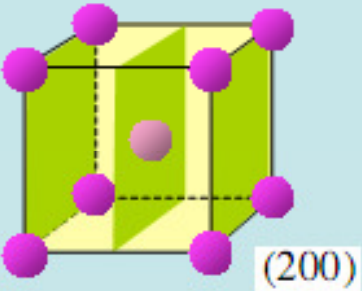


No backscattering at X-point

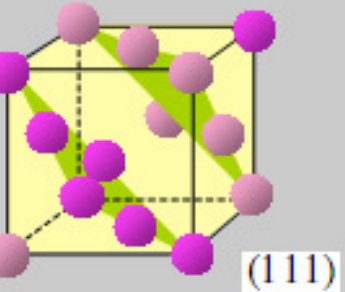
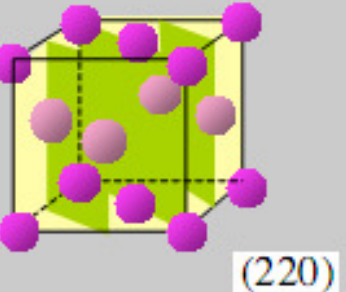
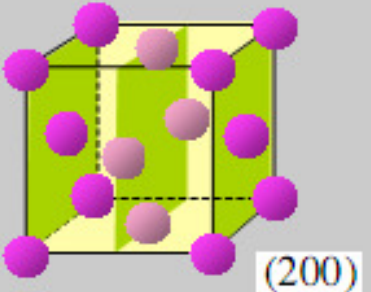
sc



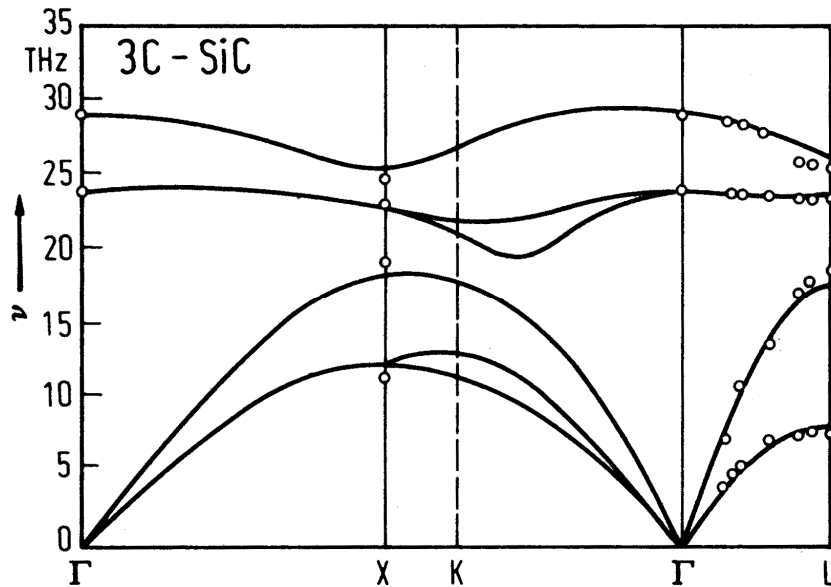
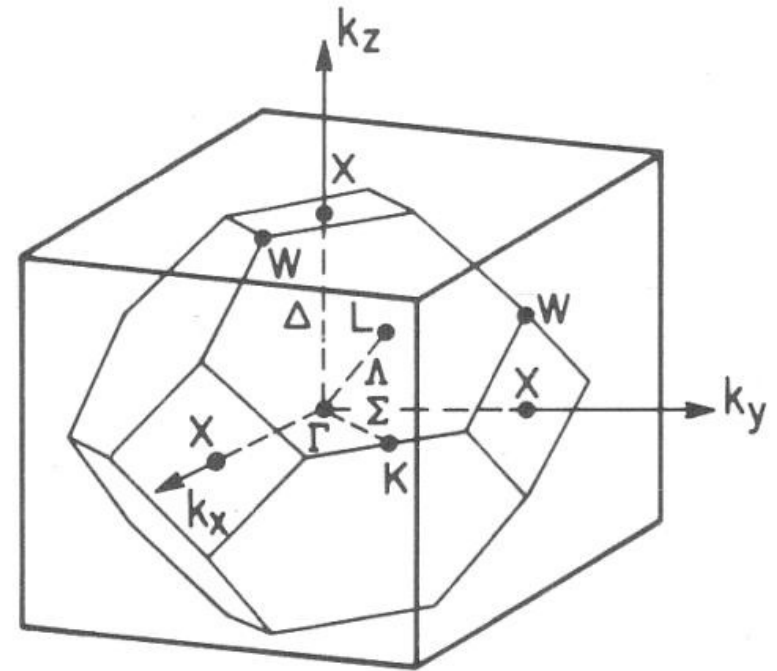
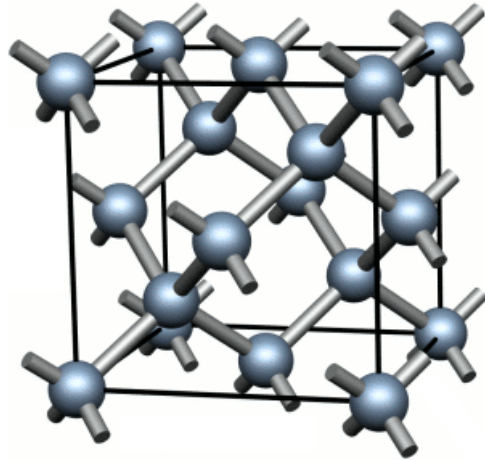
bcc



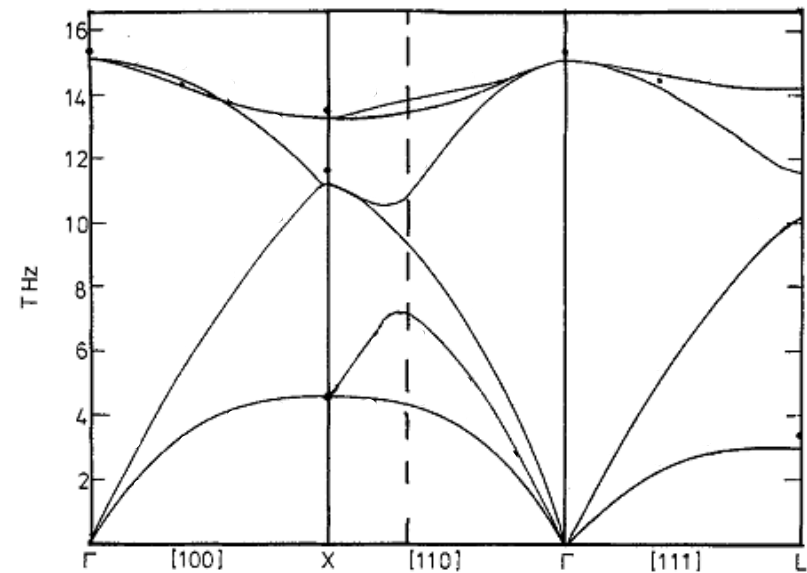
fcc



Diamond = FCC with a 2-atom basis
 C @ [0,0,0] and C @ [1/4, 1/4, 1/4]

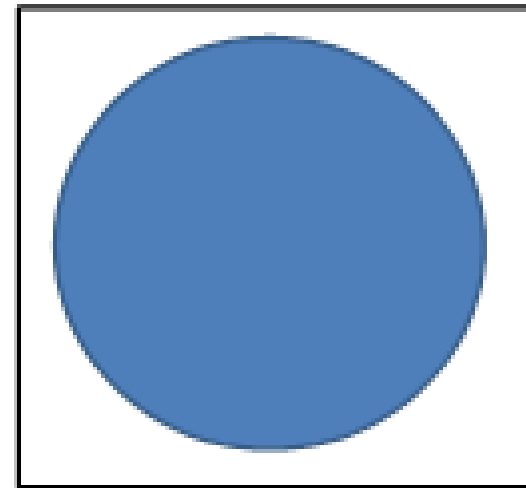
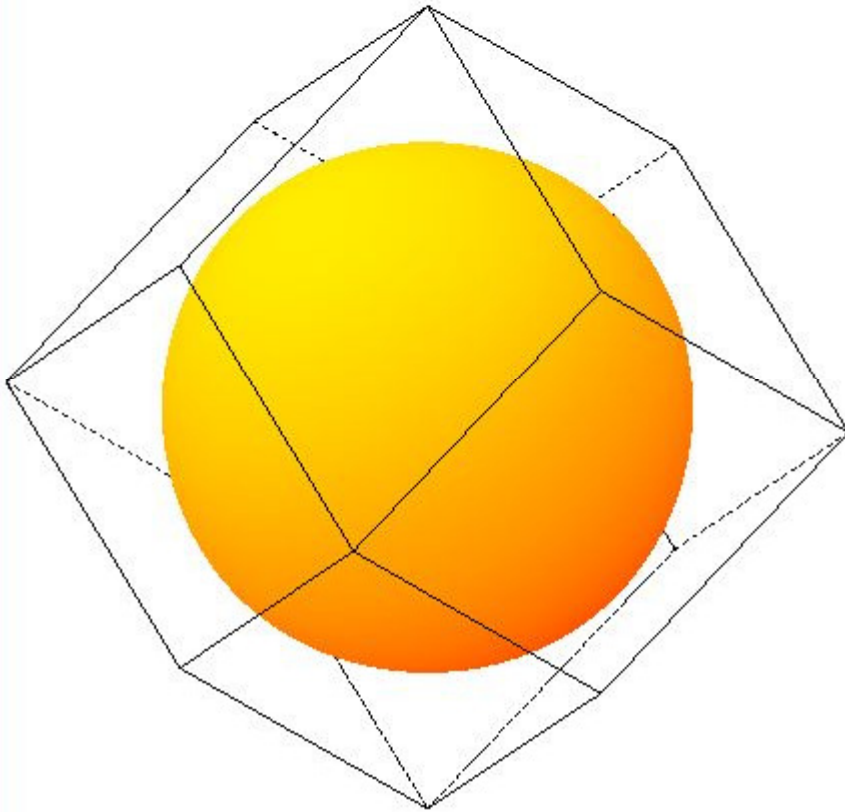


Silicon Carbide Phonons



Silicon Phonons

Na
bcc a=7.98au
1st band
electron Fermi surface
Fermi surface
file name: na1-1f.gif



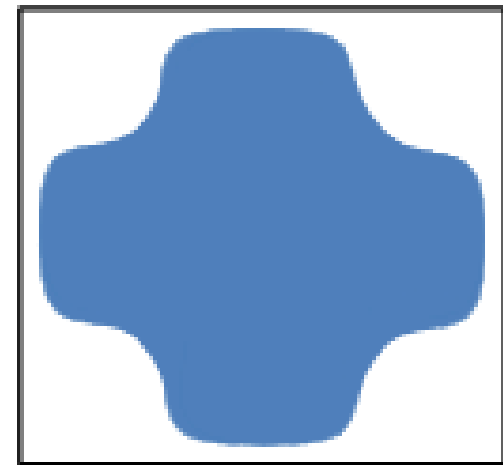
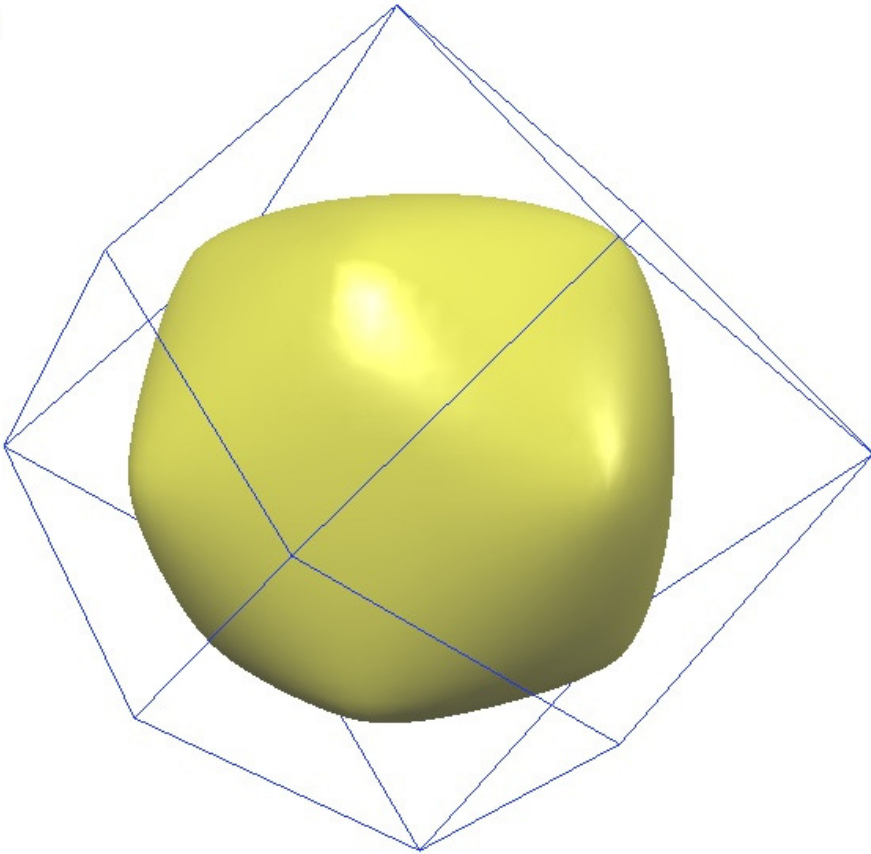
2d analogue

Fermi Surface of Sodium (BCC)

Monovalent = Half-Filled Brillouin Zone

Li
bcc a=6.59au
1st band
electron Fermi surface
Fermi surface
file name: li1-1f.gif

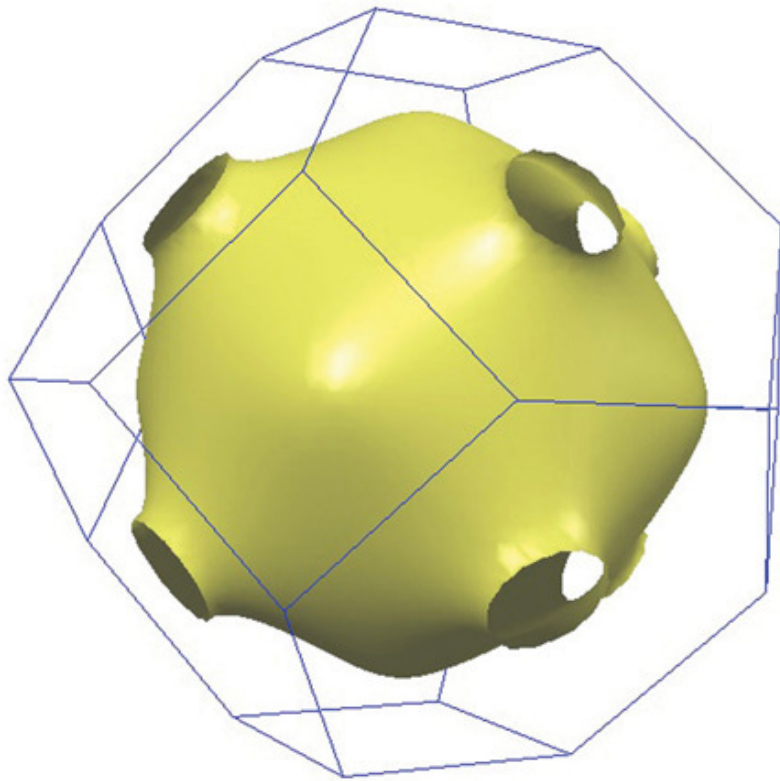
Li



2d analogue

Fermi Surface of Lithium (BCC)

Monovalent = Half-Filled Brillouin Zone



2d analogue

Fermi Surface of Copper (FCC)

Monovalent = Half-Filled Brillouin Zone



No periodic Potential
 Divalent=
 Enough electrons
 To fill 1st zone



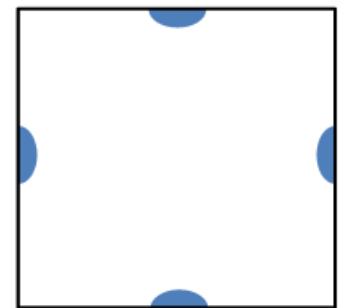
with strong periodic potential – 1st BZ exactly filled (insulator)



with weak periodic potential

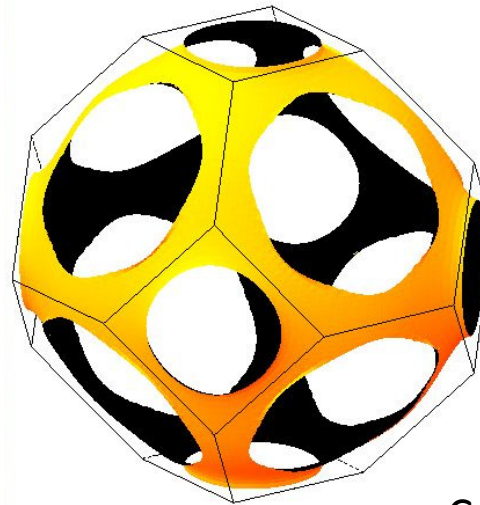


weak potential
 Lowest Band
 (in 1st BZ)



2nd band

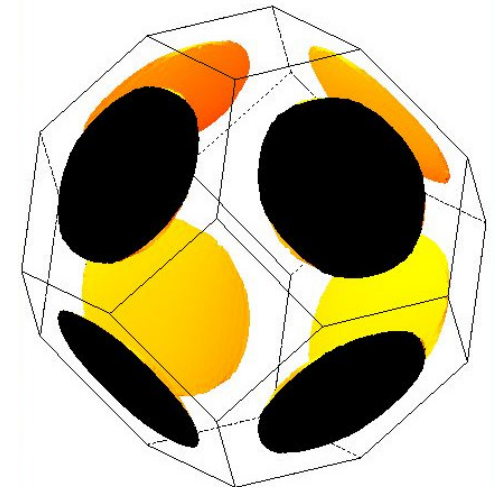
Ca
 fcc a=10.53au
 1st band
 electron Fermi surface
 Fermi surface
 file name: ca1-1f.gif



1st band

Analogue

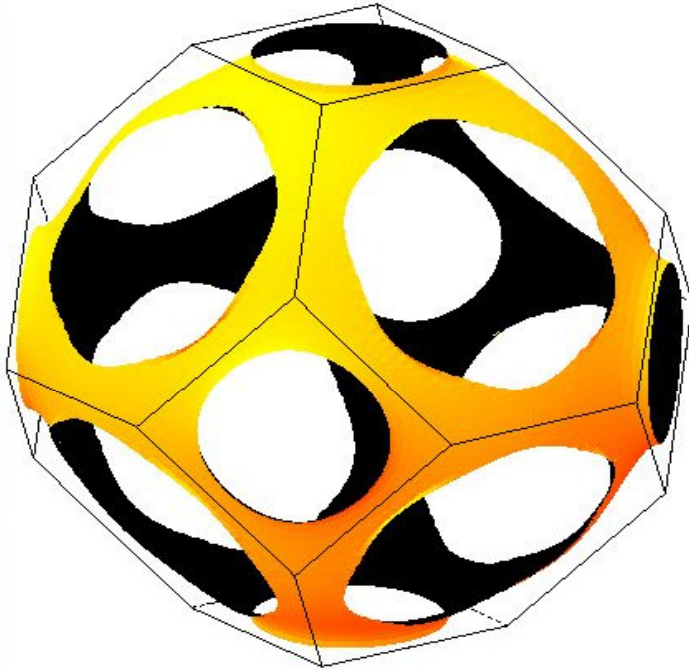
2nd band
 electron Fermi surface
 Fermi surface
 file name: ca1-2f.gif



Calcium FCC
 (Divalent)

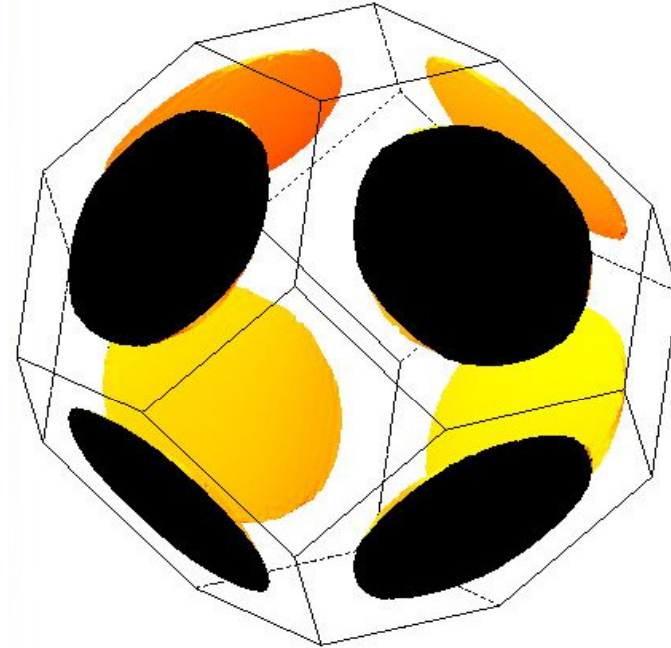
2nd band

Ca
fcc a=10.53au
1st band
electron Fermi surface
Fermi surface
file name: ca1-1f.gif



1st band

Ca
fcc a=10.53au
2nd band
electron Fermi surface
Fermi surface
file name: ca1-2f.gif



2nd band

Calcium FCC
(Divalent)