

✓ Crystals (Xtals) ⊂ Solid State Phys. ⊂ Condensed Matter ⊂ All Matter

{ Amorphous - Glass
Liquid Xtals
Quasi Xtals

Superconductivity
electron 'gas'

This is a capstone course, will use

Mechanics - vibrations, springs, coupled oscillations

E+M - waves, X rays, Bragg diffraction

Quantum Mech. - potential well, bands, $33 \sim \infty$

Stat. Mech. - Phonons, Fermi gas, Magnetization

Math - Fourier Analysis, Group Theory

Semiconductors - holes, doping, defects. Phase Transitions

Crystals

solid, periodic arrangement, 1, 2, 3 dimensions

Xtal = Lattice + Basis

✓
ideal mathematical
set of points in
space

↓
One or more atoms

Evidence for Xtals made of atoms

- macroscopic Xtals planes

Miller indices are always integers

not e.g. $(2, \pi, \sqrt{17})$

OK if fractional indices $(1, \frac{1}{2}, \frac{1}{3}) \rightarrow (6, 3, 2)$

- X-ray diffraction, Bragg, Laue, 1897 \rightarrow 1907



Pattern is the Fourier Transform of the Scatterer.