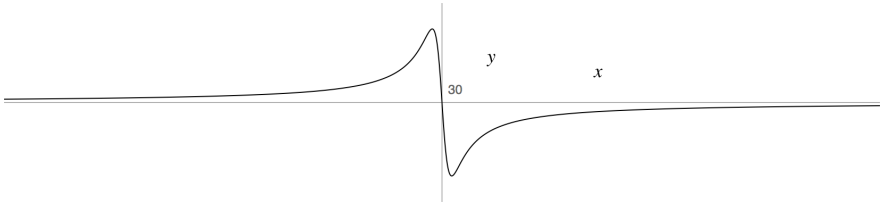
Tue. Oct 22, 2013: elastic light scattering

Properties of light, how light interacts with matter, and how light interacts with itself.
Reference material: "Elastic Scattering" web **Notes** on kinemage website:
http://kinemage.biochem.duke.edu/teaching/BCH681/2013BCH681/
...continuing: **First Issue:** Scattering from 1 point (and the object small compared to wavelength of light).
...Notes Section 1. Light Scattering
a. The driving wave interacts with an oscillator.
b. Oscillator phase lag is a function of its natural frequency and frequency of driving light wave.
c. Oscillator can radiate light in any direction at the same frequency and phase as its oscillations.
...refer to styrofoam ball on fuzzy yarn...

b. plot of equation...

n = refractive index (y axis, arbitrary scale), ω frequency of driving wave (x axis)
Selenium edge: $\omega_0 = 3 * 10^{18}$ sec^{-1} = .98Å



$$n = 1 + \frac{Nq^2}{2\varepsilon m\left(\omega_0^2 - \omega^2 + i\gamma\omega\right)}$$

note damping term: $i\gamma\omega$ & components of scattering form factor of an atom: $f_{total} = f_0 + f' + if''$

c. scattering in all directions: **polarization** of light as a function of scattering angle.
Study question: aspect of oscillator as a function of viewing direction... polarization equation
(view of board eraser...)

Lecture notes:
LIGHT AS A WAVE Equation of interaction with oscillator
Describing waves, the phase clock
PHASE SHIFT through resonance frequency ...

Second Issue: Scattering from more than 1 point, 2 to many...

Notes Section 2. Molecular Scatter

Information from an elastic light scattering experiment: **distance, direction**.
[and the simple concept of two waves completely in phase, i.e. peaks line up perfectly.]
Study question: general diagram directly measuring **distance** between 2 objects at a particular arbitrary **direction** from each other. Confirm Bragg's law, $\lambda = 2d\sin(\theta)$, symmetrical in---out rays, that for a particular wave length produce in-phase output. Also show $n\lambda = 2d\sin(\theta)$ {show phase clocks}
Afterwards show d normal to "Bragg Planes" on which any point would scatter in phase with Bragg's law. (and any scattering points off-of-plane by the same amount would be in phase with each other)

COMBINATION OF [X-RAY : LIGHT] WAVES
VECTOR NOTATION FOR WAVES
and on to the General Scattering Equation...