Thur. Oct 17, 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/
As well as detailed lecture notes, there are a number of pages with background reference material. The total is a great more detail than will be covered in class.

Elastic Light Scattering: one photon in ... one photon out of the same energy.

Information from an elastic light scattering experiment: **distance, direction**,
(sometimes characterization of the scattering objects).

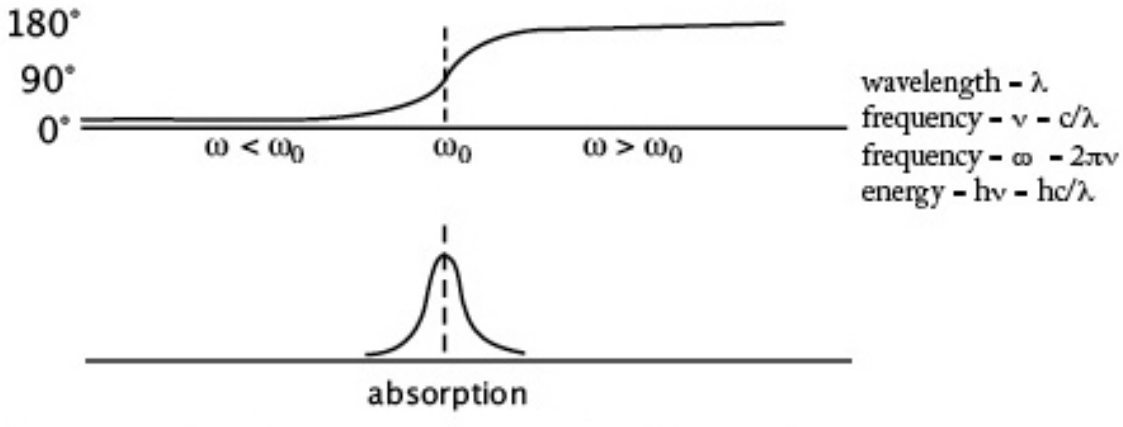
Study Question: Given **distances** and **directions**, what model can be constructed of the objects?

So, how does elastic light scattering yield distance and direction information?
First Issue: Scattering from 1 point (and the object small compared to wavelength of light).

Notes Section 1. Light Scattering

Ways of describing the incoming light:
Ray direction of wave propagation, or direction of a beam of photons.
Wave of wavelength λ, each wave broad and long enough to perform as expected.
Photons specific quantum energy ∝ 1/λ, a photon = 1 quantum, a chunk of a wave broad and long enough to perform as expected.

Light interacts with matter: The driving wave interacts with an oscillator. Considering the sinusoidally varying electric field of the wave, the oscillator must involve an oscillating dipole, this could be an induced dipole in a polarizable object. So we are getting a measure of polarizability of a medium, e.g., molecules, or for our first simple case, one electron of an atom. An oscillating charge acts like an antenna and can radiate light in any direction at the same frequency and phase as its oscillations.
The interaction of the incoming light wave and the oscillator (electron) can be described as driven, damped, simple harmonic motion and is an example of resonance.



DEMO: plumb bob pendulum (variable frequency) driving pendulum Styrofoam ball oscillator (electron). Relative phase of plumb bob (driving wave of frequency ω) with ball pendulum (native frequency ω_0)
Study question: plumb bob support provides the coupling. Why does the motion of the supporting beam NOT affect the phase relations?