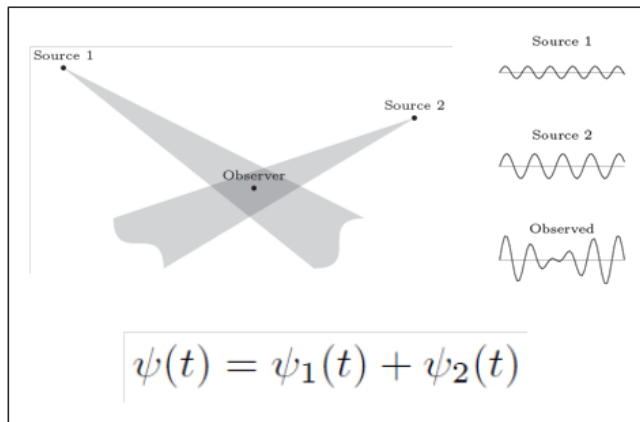


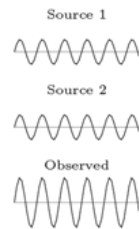
Wave Interference



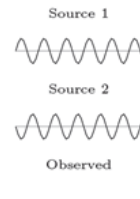
When the disturbances from two sources combine the instantaneous amplitudes add



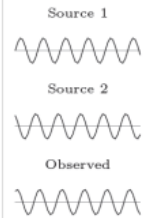
**In Phase
(Constructive)**



**Out of Phase
(Destructive)**



Intermediate

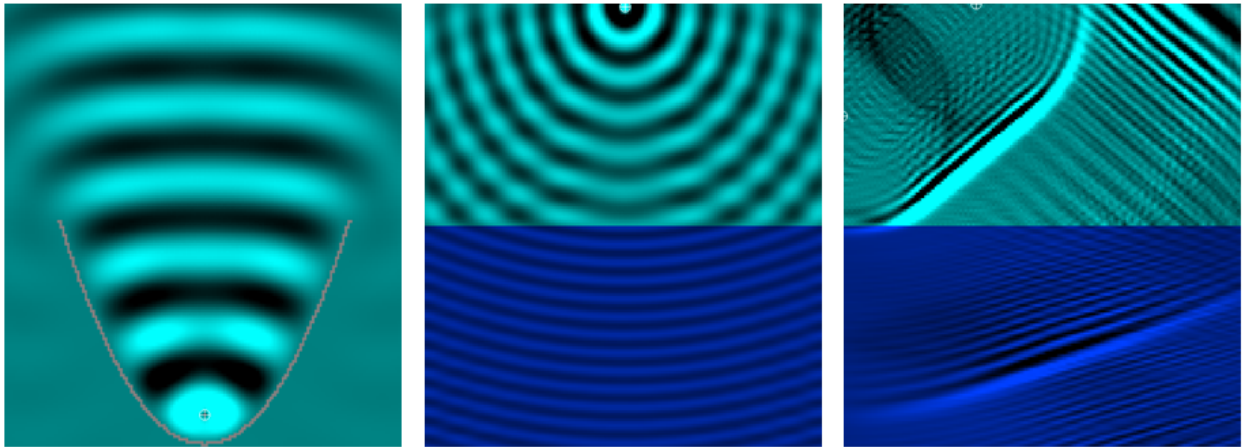


$$\Delta\phi = -(2\pi/\lambda)\Delta x$$

$$\Delta\ell = n\lambda$$

$$\Delta\ell = (n + \frac{1}{2})\lambda$$

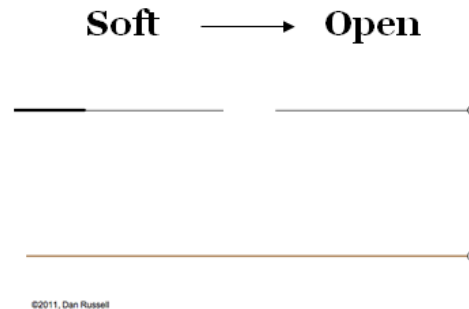
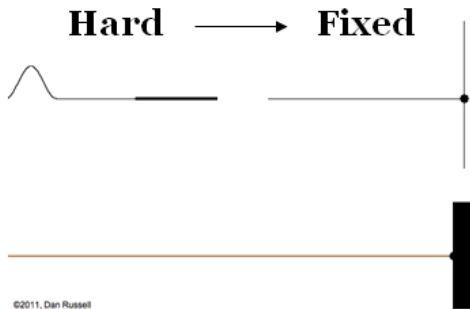
Reflection and refraction of waves provide a mechanical model for light and sound



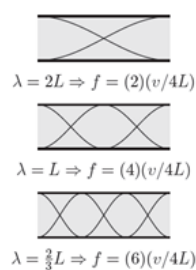
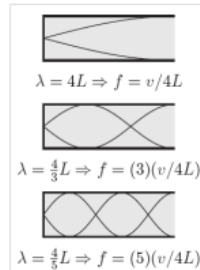
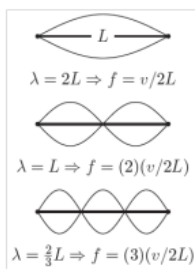
<http://www.falstad.com/ripple/>

<http://www.falstad.com/mathphysics.html>

Reflection off a boundary acts as a second source that can produce standing waves



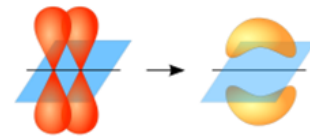
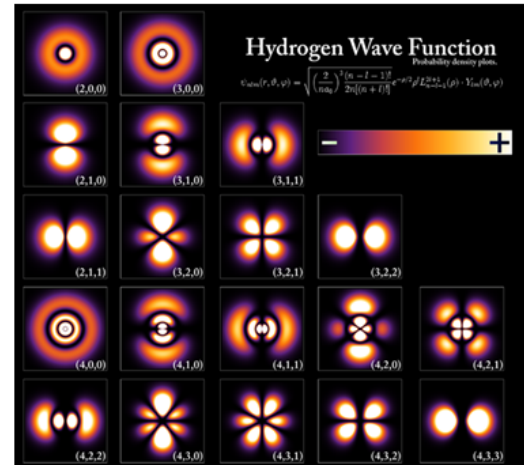
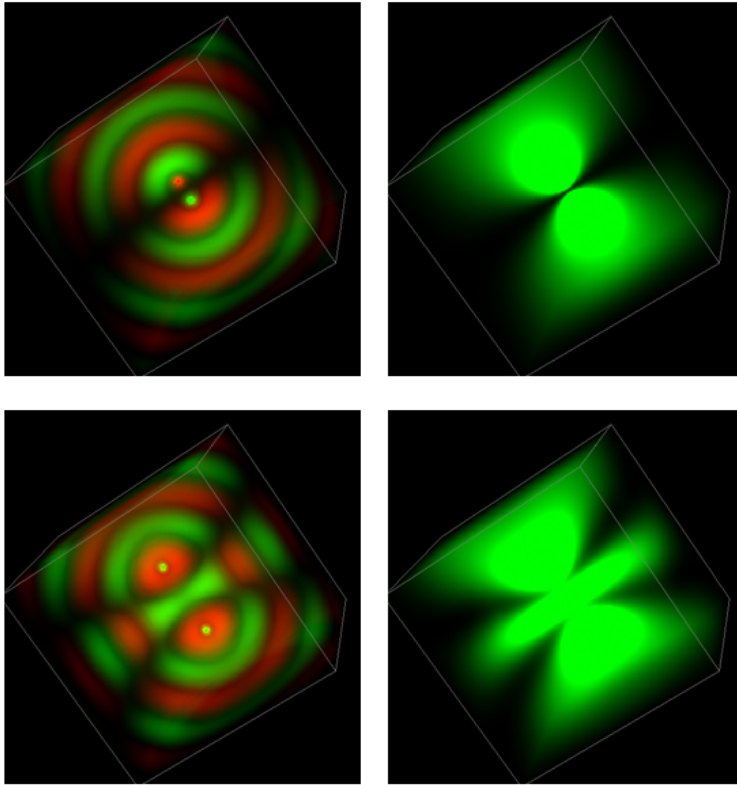
<http://www.acs.psu.edu/drussell/Demos/>



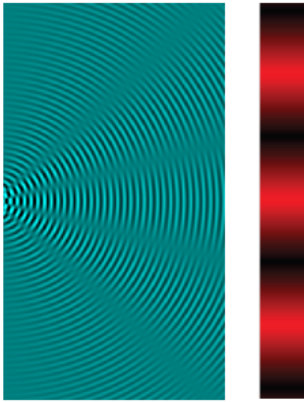
$$f_n = n \frac{v}{2L}$$

$$f_n = (2n - 1) \frac{v}{4L}$$

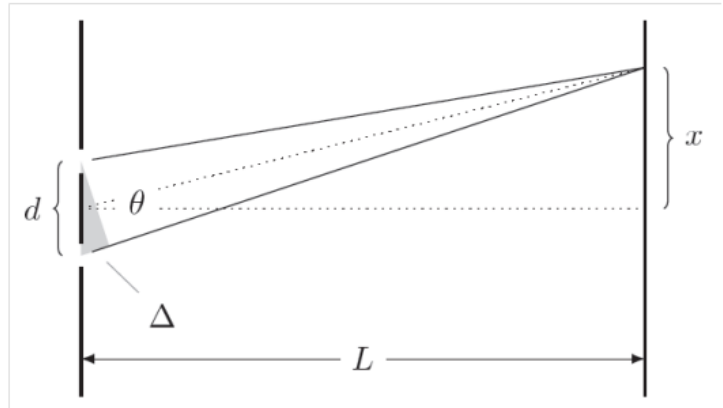
Three-dimensional standing waves are used to build microphones, antenna, and atoms



Double slit experiment provides definitive evidence for the wave nature of light

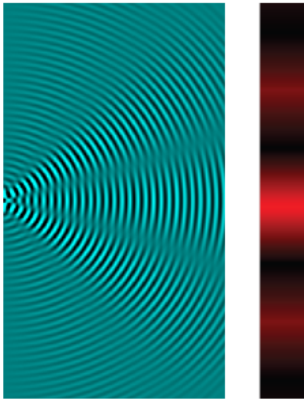


$$\sin \theta = n\lambda/d$$



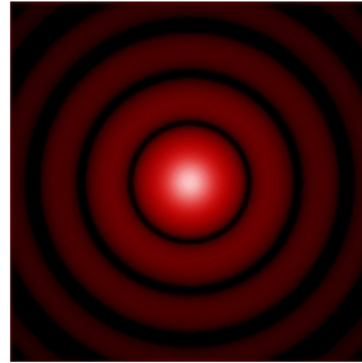
$$\Delta \ell = d \sin \theta$$

Single slit diffraction can be understood as the interference of a series of single sources



$$\theta = n\lambda/a$$

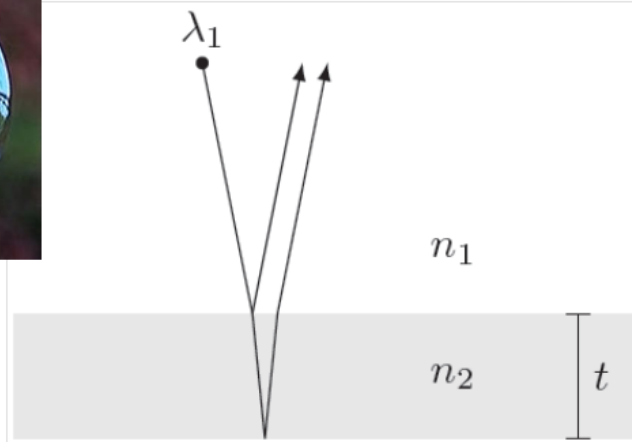
$$I = \left[\left(\frac{\lambda}{\pi a \theta} \right) \sin \left(\frac{\pi a \theta}{\lambda} \right) \right]^2$$



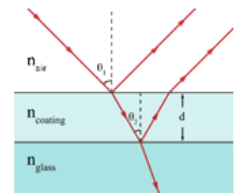
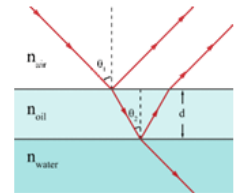
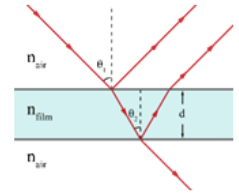
$$\theta_{\min} = 1.22\lambda/D$$



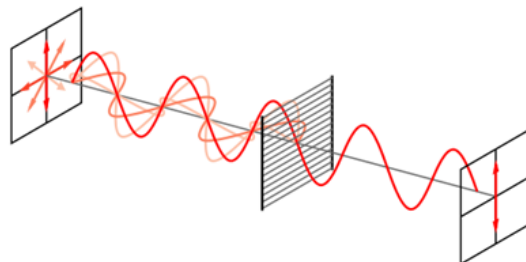
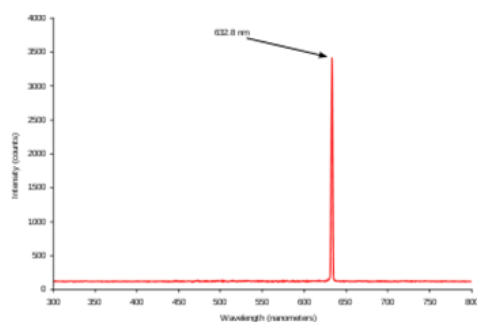
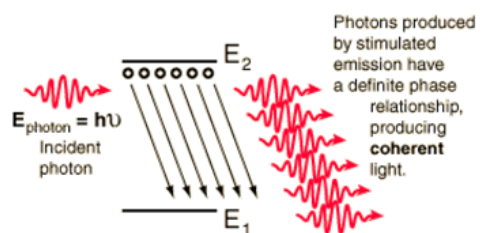
Iridescence in nature is usually from thin-film interference



$$2t = (m + \frac{1}{2})(n_1/n_2)\lambda_1$$



The difference between incandescent and laser light is the coherence of the waves



$$I = I_0 \sin^2 \theta$$

