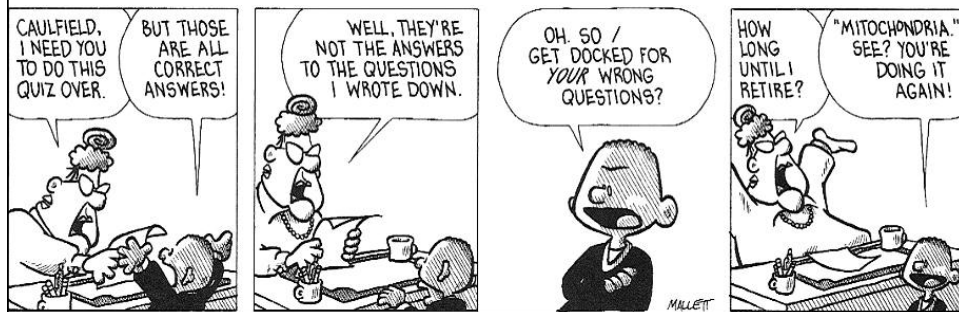


May 8, 2017

Physics 132

Prof. E. F. Redish

■ Theme Music: Count Basie*Light and lovely***■ Cartoon: Jef Mallett***Frazz*

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Physics 132

1

Outline

- Interference: recap of principles
- Examples
- Diffraction
- Two slit diffraction

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Physics 132

3

EvalUM is open

- Please do your evalUM rating for this class.

<http://CourseEvalUM.umd.edu>

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Physics 132

4

Foothold wave ideas: Huygens' Model



- The critical structure for waves are the lines or surfaces of equal phase: wavefronts.
- Each point on the surface of a wavefront acts as a point source for outgoing spherical waves (wavelets).
- The sum of the wavelets produces a new wavefront.
- The waves are slower in a denser medium.
- The reflection principle and Snell's law follow from the assumptions of the wave model.
- We can even make rays – sort of.

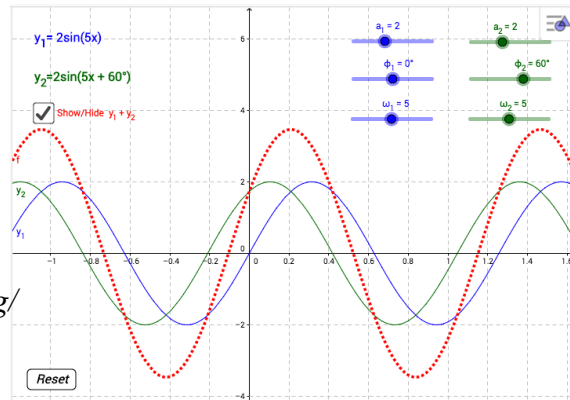


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Interference

- When we add two sine waves **of the same frequency**,
 - if their phases differ by $0, 2\pi, 4\pi$,
.... they add (*constructive interference*).
 - if their phases differ
by $\pi, 3\pi, 5\pi$,
they cancel
(*destructive interference*)



<https://www.geogebra.org/m/BOMfKCIK>

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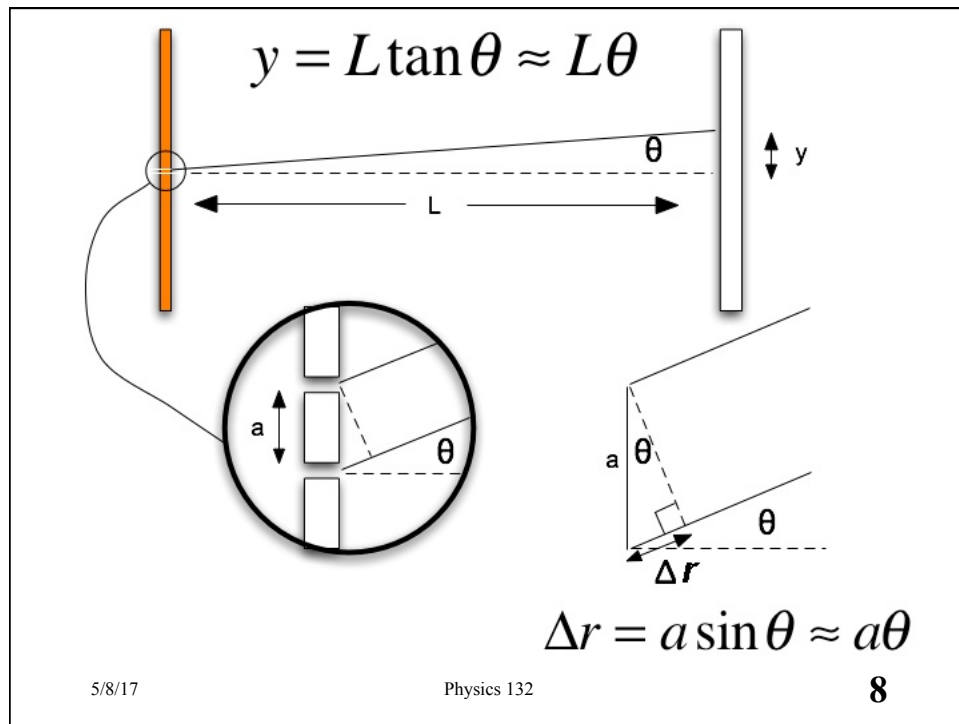
Phase difference and path difference

- Our two waves from different sources have a phase difference, $\phi_1 - \phi_2$ because we are different distances from the two sources.
- The phase difference depends on the path difference:

$$\phi_1 - \phi_2 = kr_1 - kr_2 = k(r_1 - r_2) = k\Delta r = 2\pi \left[\frac{\Delta r}{\lambda} \right]$$

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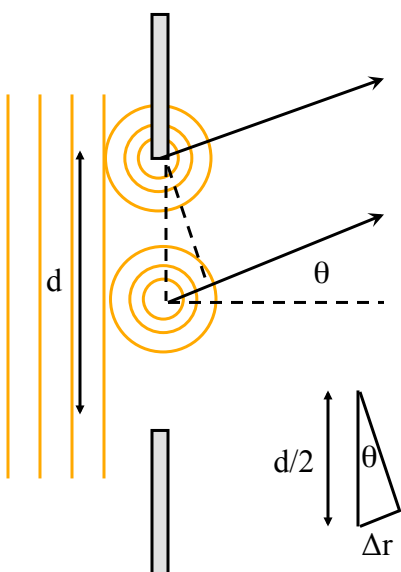
How many wave lengths fit into Δr ?



Diffraction

- Every bit of the interior of the slit acts as a source of outgoing spherical Huygens' wavelets.
- The outgoing wavelets from one part of the slit can interfere with the wavelets from another part of the slit.

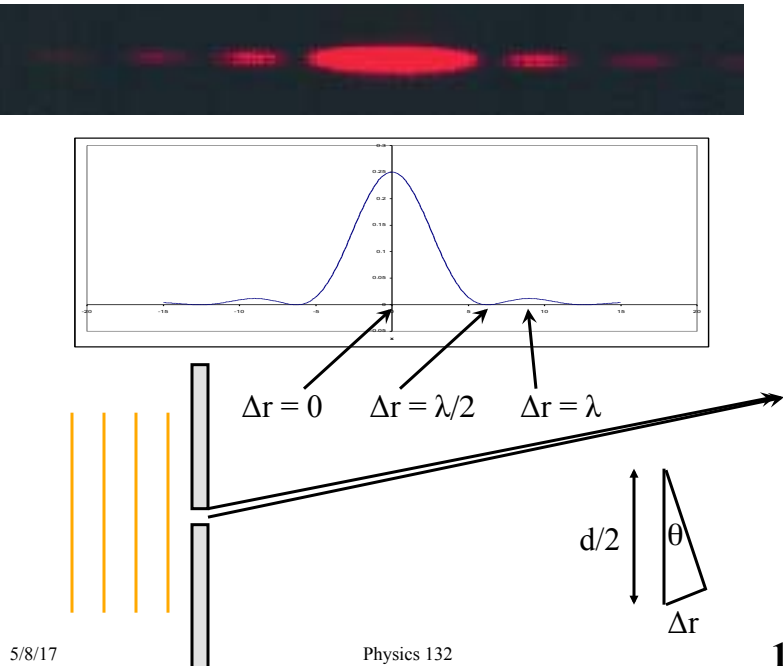
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When the distance traveled by the wavelet from the middle of the slit is half a wavelength greater than the distance traveled by the wavelet from the top of the slit every wavelet from the top half of the slit has a canceling wavelet from the bottom half of the slit.

The result is no intensity at that angle.

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$\Delta r = 0$ $\Delta r = \lambda/2$ $\Delta r = \lambda$

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