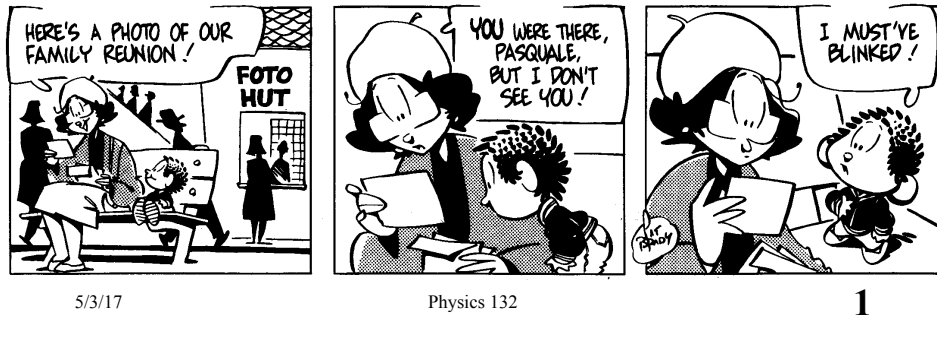


May 3, 2017

Physics 132 Prof. E. F. Redish

- **Theme Music: Kronos Quartet**  
*Tashweesh (Interference)*
- **Cartoon: Pat Brady**  
*Rose is Rose*



## Outline

- Quiz 11
- Survey
- Huygens' model recap
- Adding sine waves
- Interference
- Examples

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## 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.

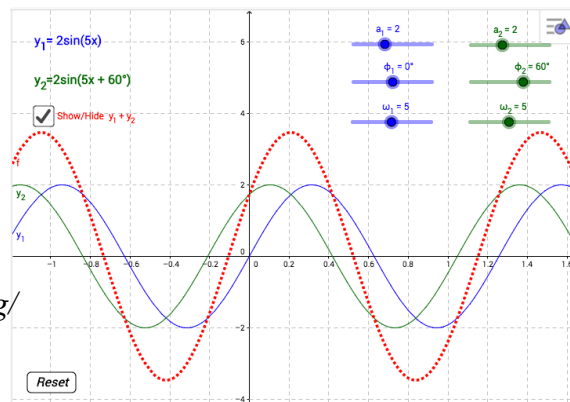


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## Interference

- When we add two sine waves of the same frequency,
  - if their phases differ by  $0, 2\pi, 4\pi, \dots$  they add (*constructive interference*).
  - if their phases differ by  $\pi, 3\pi, 5\pi, \dots$  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.
 
$$y = A \sin(kr_1 - \omega t) + A \sin(kr_2 - \omega t)$$

$$y = A \sin(\phi_1 - \omega t) + A \sin(\phi_2 - \omega t)$$

- 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  $\Delta r$ ?*