- **Theme Music:**
  Carl Clements
  Diffraction
- **Cartoon:**
  Pat Brady
  Rose is Rose

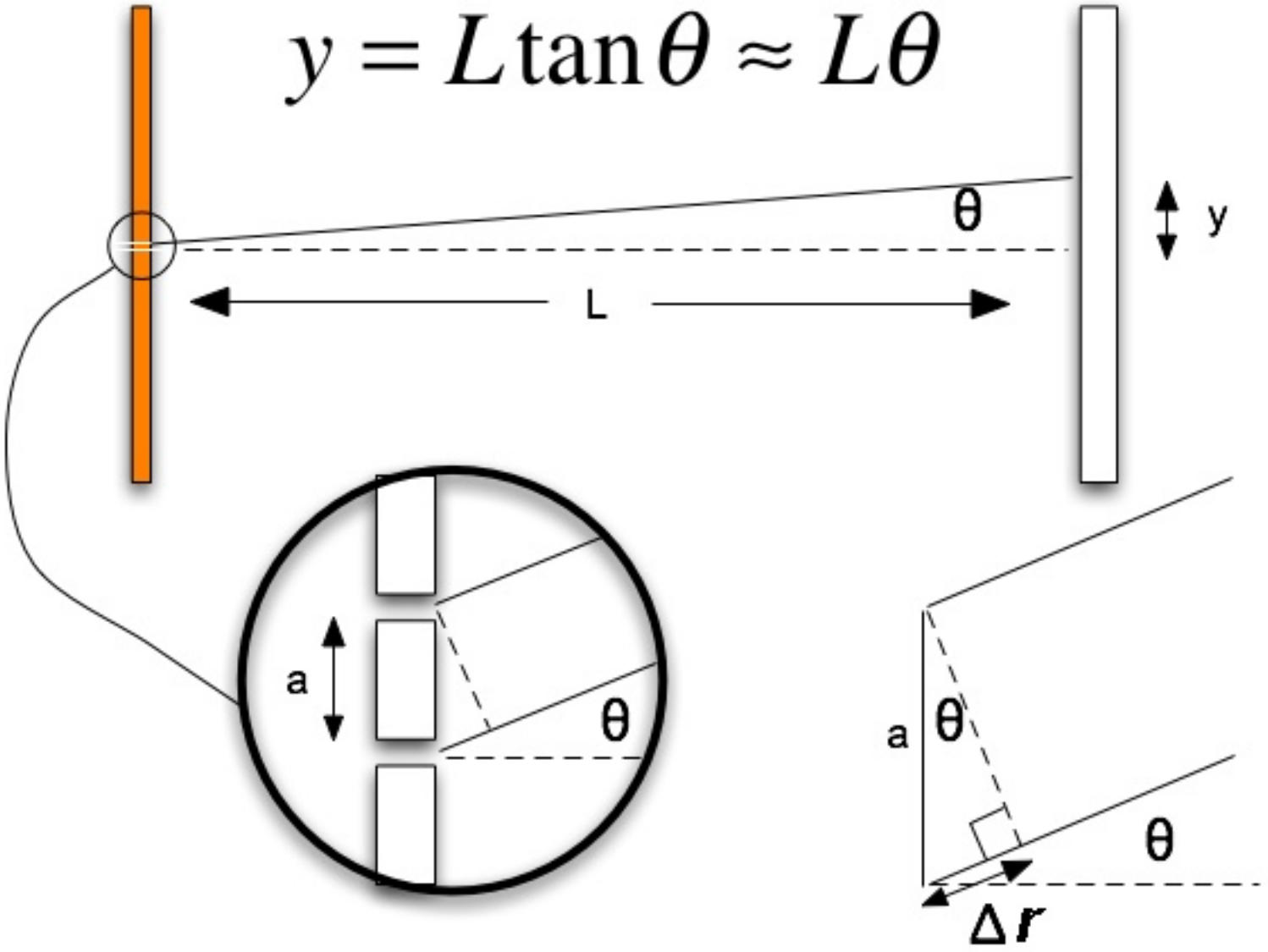
Foothold ideas: EM waves

- Point source:
  - An oscillating charge sends out a sphere of oscillating EM wave.
- Wavelets:
  - Any point in space with an oscillating EM wave sends out a sphere of oscillating EM wave.
- Superposition:
  - The resulting pattern at any point is the sum of the waves received.

Analysis of models

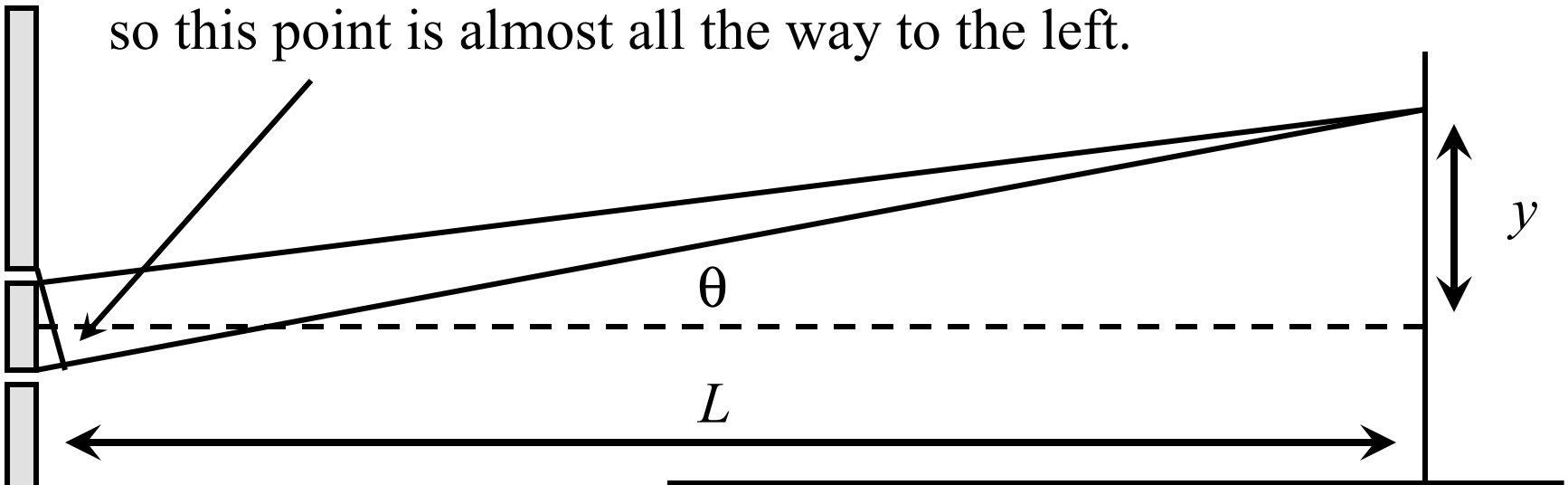
- Model 1:
  - One slit (where we can neglect the width) produces an outgoing oscillating EM wave.
- Model 2:
  - Two slits (where we can neglect the width) add together and the result depends on where you are (2 slit pattern)
- Model 3:
  - One slit (where we cannot neglect the width): Each bit of the slit acts like a narrow slit source. You have to add them all together to get the result (1 slit pattern)
- Model 4:
  - Two slits (where we cannot neglect the width): the two patterns multiply together.

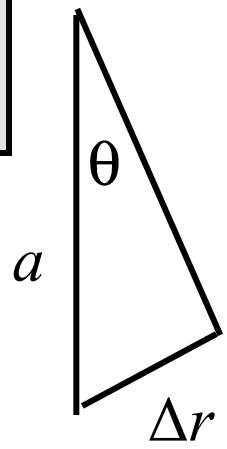
$$y = L\tan\theta \approx L\theta$$



$$\Delta r = a\sin\theta \approx a\theta$$

Slits are really much, much closer than shown
so this point is almost all the way to the left.





$$\sin\theta = \frac{\Delta r}{a}$$

$$\tan\theta = \frac{y}{L}$$

Maximum when

$\Delta r = \lambda,\ 2\lambda,\ 3\lambda,\ldots = n\lambda$

Minimum when

$\Delta r = \frac{1}{2}\lambda,\ \frac{3}{2}\lambda,\ \frac{5}{2}\lambda,\ldots = (n+\frac{1}{2})\lambda$

For small angles,
$\sin\theta \sim \theta,\ \tan\theta \sim \theta$

$$\Rightarrow \quad \frac{\Delta r}{a} = \frac{y}{L} \quad \Rightarrow \quad y = \Delta r\left(\frac{L}{a}\right)$$