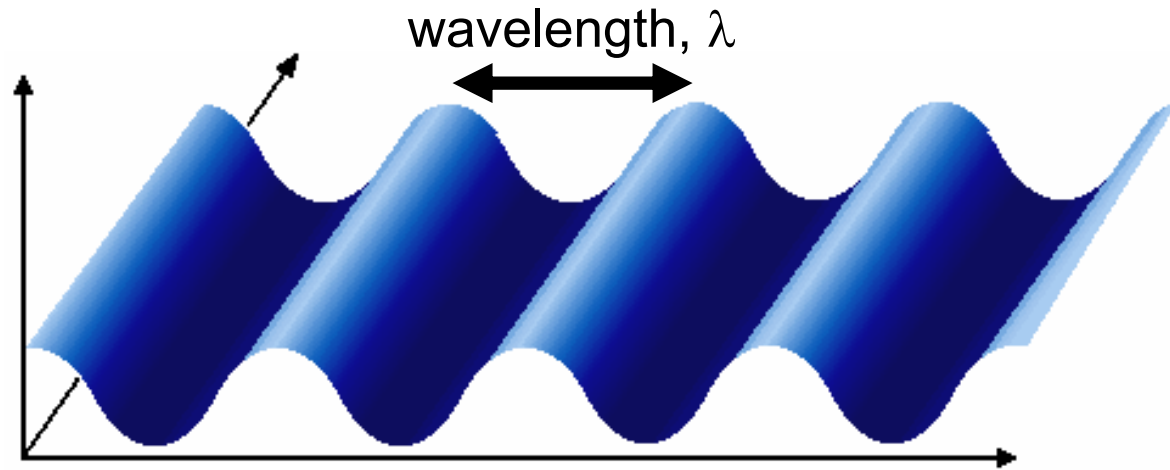


Back to Light

- Early 1800s Thomas Young: Demonstrated the wave like behavior in light. Young managed to produce an interference pattern from light diffraction through a narrow slit.
- 1905 Albert Einstein: Light is both a particle and a wave (amazing but true)

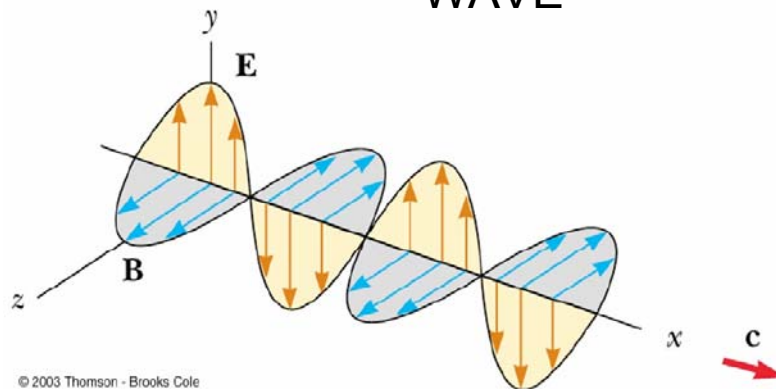


PARTICLE

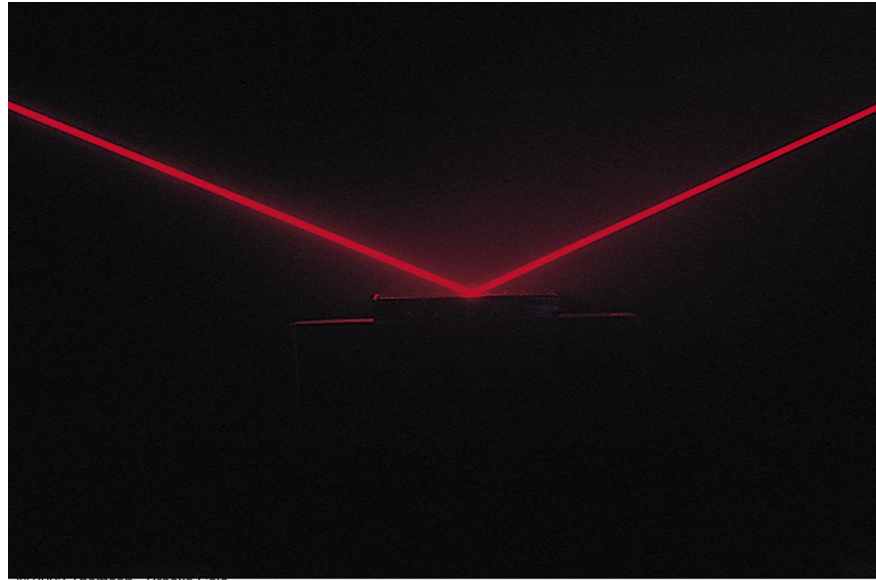


WAVE

Electromagnetic
wave

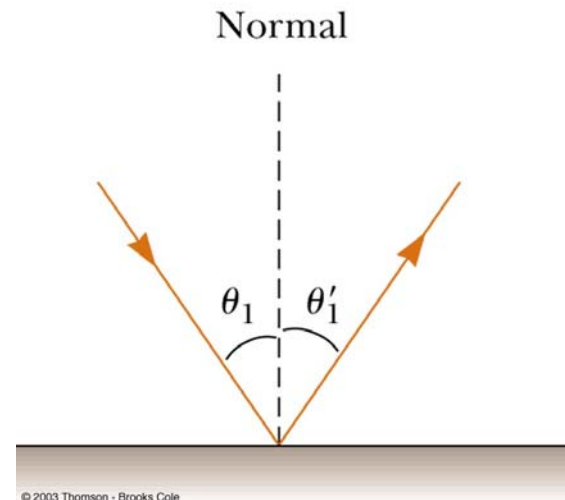


Remember Reflection



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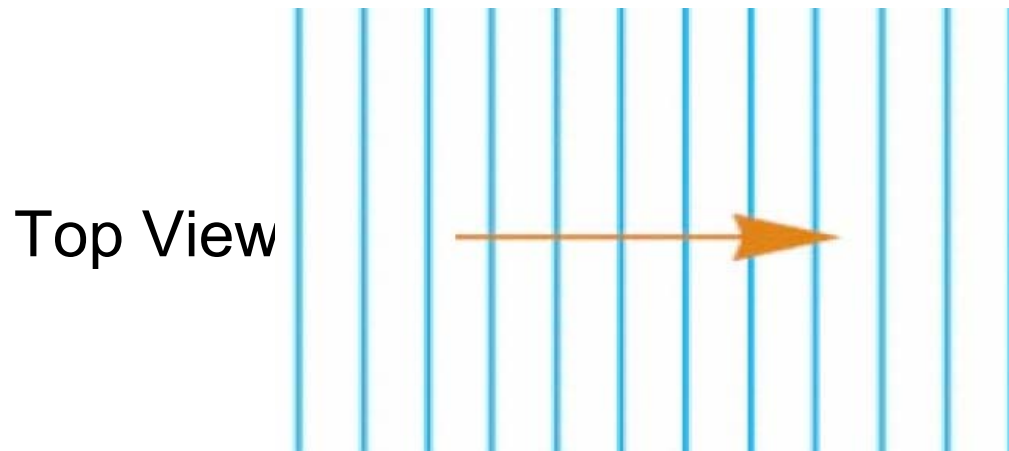
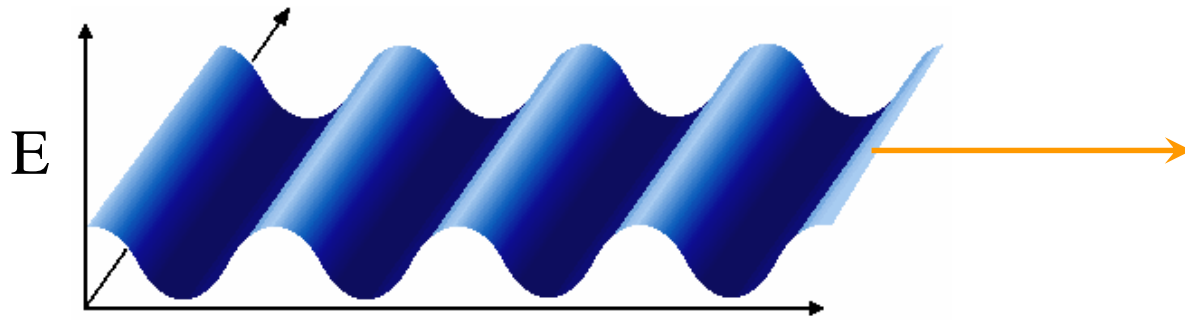
- The angle of reflection is equal to the angle of incidence: $\theta_1 = \theta_1'$
→ just what you'd expect if light were a stream of PARTICLE bouncing off the surface



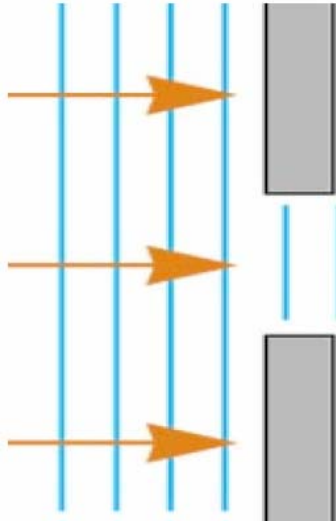
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Today

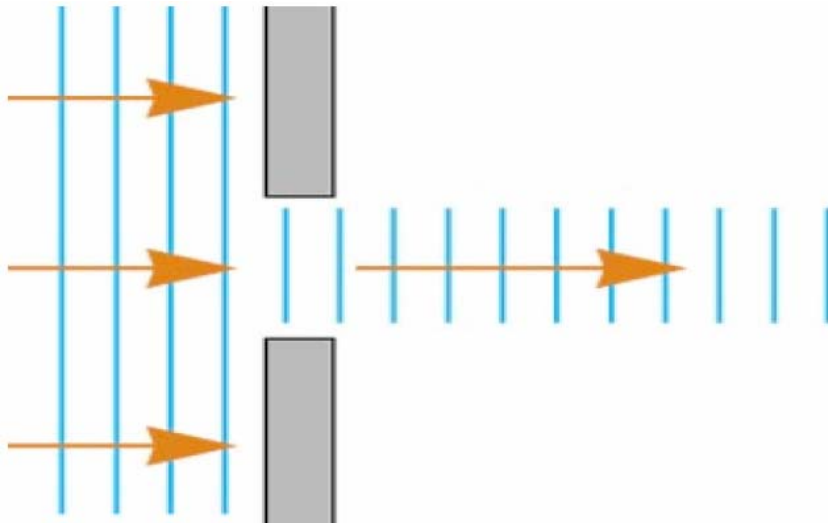
We will prove that light acts like a wave.



Young's Experiment



- Shine light on a narrow slit
- We will use the laser, which makes a beam of coherent light – with a precise wave length
- Light will pass through the slit



Q. Will it emerge as an even more narrow beam?

A. No

Diffraction

Diffraction = the bending of waves around corners



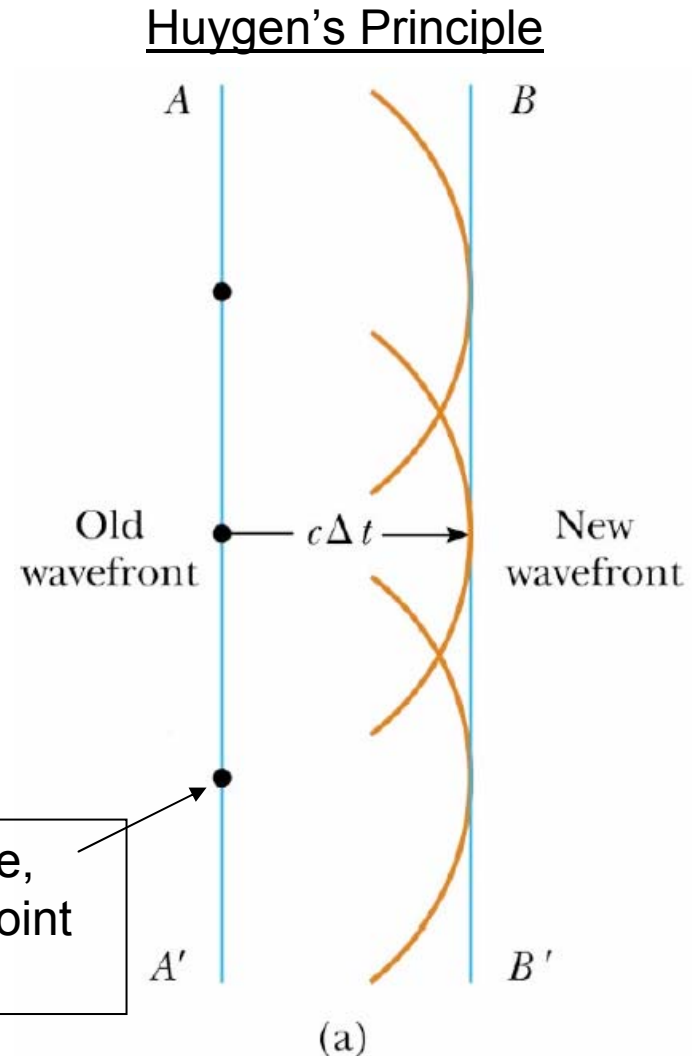
Huygen's Principle

Diffraction can be understood as a consequence of Huygen's Principle.



This is Christian Huygens. He was a Dutch physicist and astronomer who lived between 1629-1695. He found new methods for grinding and polishing lenses, making telescopes more powerful. Using a telescope he had made, Huygens first identified Saturn's rings and one of Saturn's moons. Huygens also invented the pendulum clock, increasing the accuracy of timekeeping, and proposed the wave theory of light.

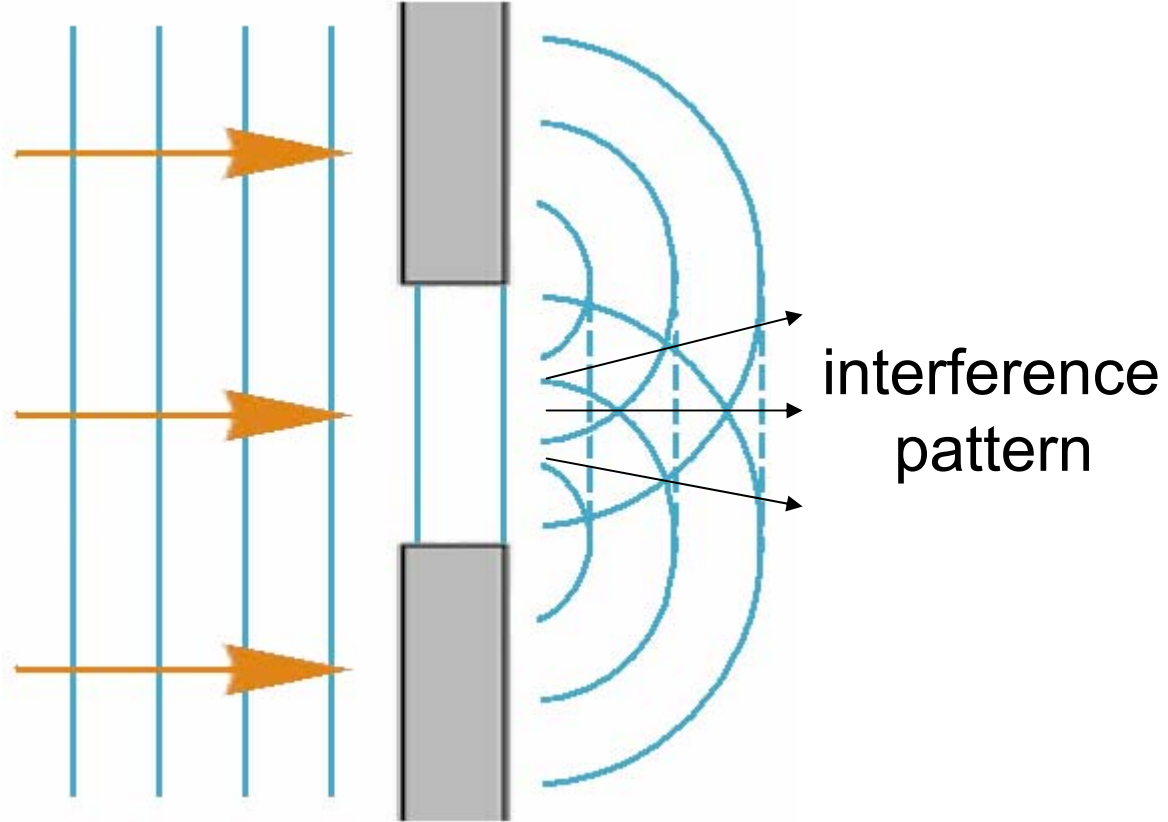
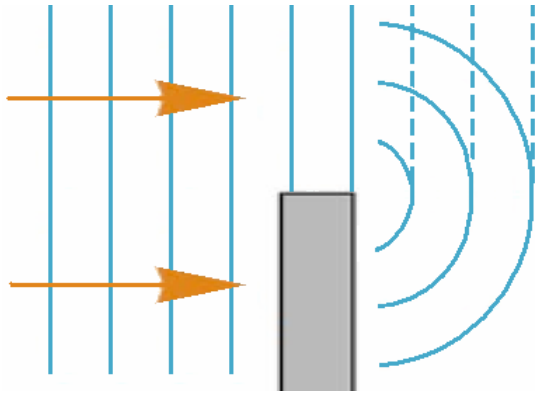
Each point along the wave, can be considered as a point source for a new wave.



Interference

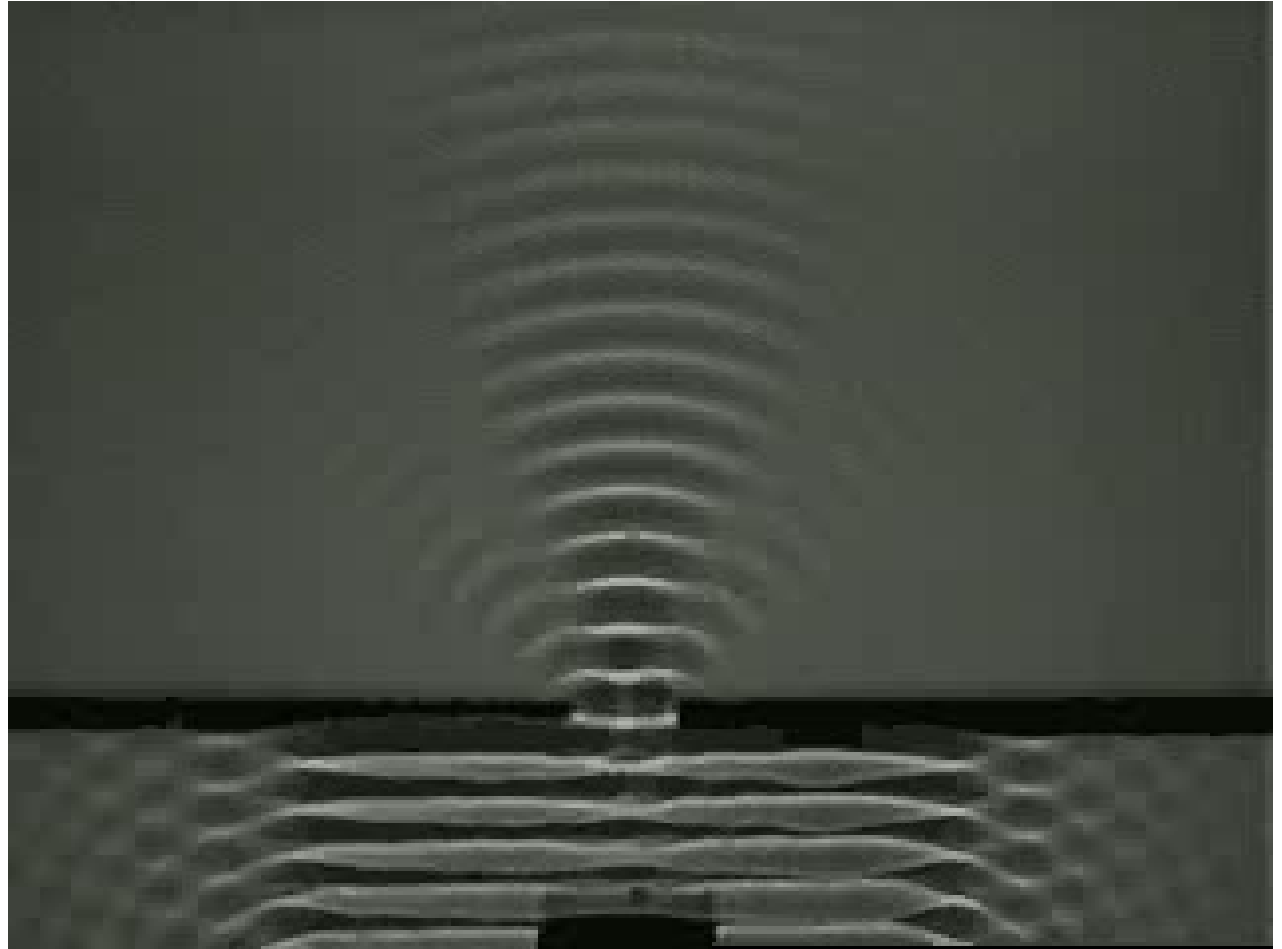
two edges = a slit

one edge

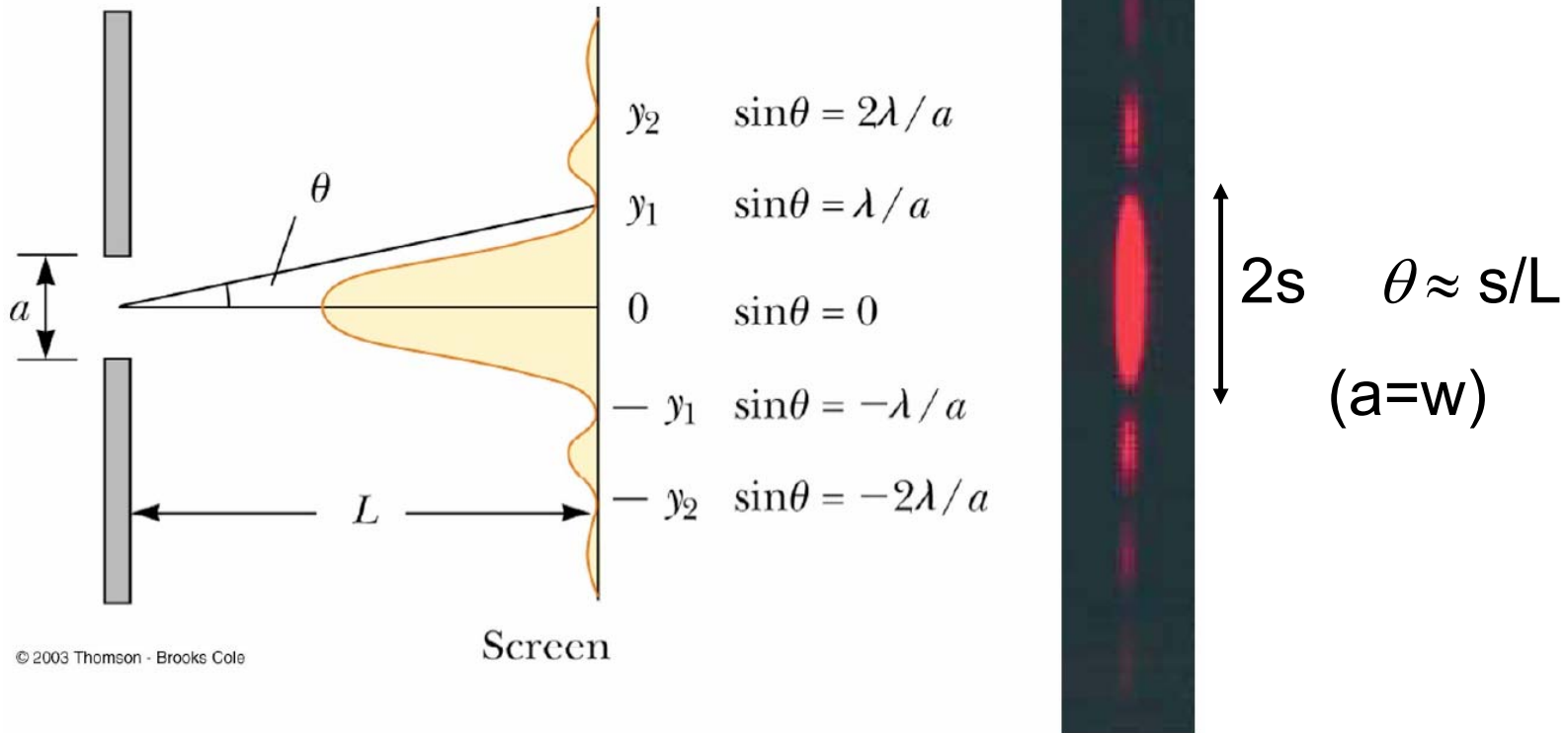


Single Slit Interference

- The rings cross at some places, giving extra amplitude to the wave
- A pattern of bright and dark spots emerge



Single Slit Diffraction Pattern



We can use the angle to first minimum (dark spot) to determine the wavelength of the light (if we know the size of the slit).

$$\lambda = w \sin\theta \approx ws/L$$

Babinet's Principle

“Opposite” barriers produce the same interference pattern. All that matters is the position of the edges.

