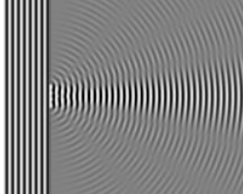


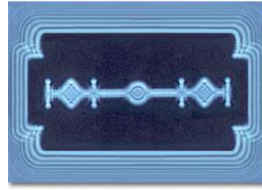
# PHY385-H1F Introductory Optics

Class 20 – Outline: 10.1

- Diffraction
- Single-slit: Fraunhofer approximation
- Fraunhofer vs. Fresnel Diffraction



## Diffraction



Francesco Grimaldi

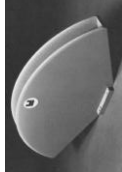
- Sometimes light does not travel in straight lines, or rays. The rays bend around edges, because light is actually a wave.
- This was first noted and discussed by Grimaldi in 1640.
- (Grimaldi also discovered the freefall equation  $d = \frac{1}{2} a t^2$ .)

## Diffraction Horn

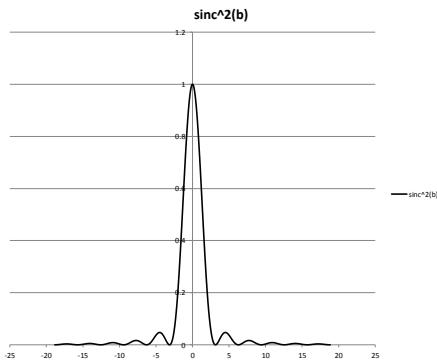
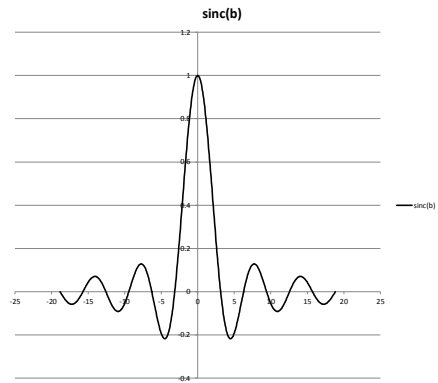
A diffraction horn is designed to spread sound over a large listening area, such as a room full of people. It's narrow width is much smaller than the wavelength of sound. If you want to spread the music around the room horizontally, should the horn be mounted horizontally as in photo 1, or vertically as in photo 2, or 3: neither?



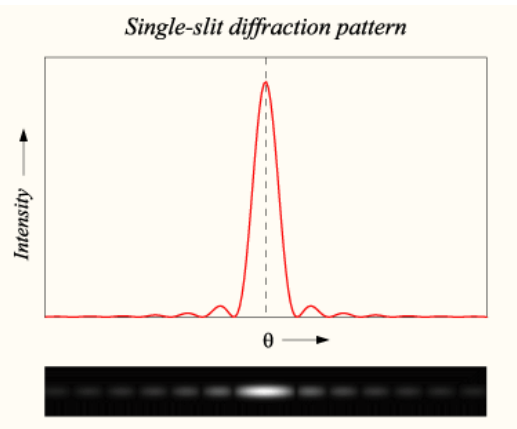
1



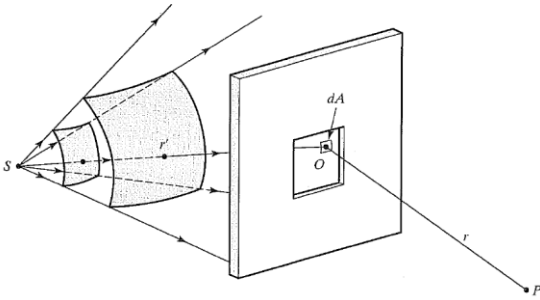
2



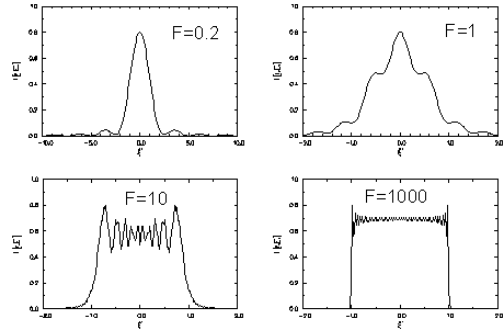
## Single-slit diffraction pattern



## Fresnel Diffraction Geometry



$$F = \frac{a^2}{L\lambda}$$



## Fraunhofer vs Fresnel

- Light of wavelength 500 nm is incident upon a single slit. The point-source is located 25 cm in front of the slit, and the viewing screen is located 25 cm beyond the slit. The slit width is 0.1 mm. Which is true?
  1. No diffraction will occur.
  2. You can model this with Fraunhofer diffraction.
  3. You must model this with Fresnel diffraction