

PHYS 2022 - Homework 10  
Due Wednesday, April 14, 2010

Reading:

French: Chapter 8; Y&F or Haliday: Interference, Diffraction.

Problems:

1. French 8-8
2. A laser beam with wavelength  $10^{-5}$  cm is aimed from Earth to the Moon. The radius of the beam is 10 cm. Neglecting the atmosphere, estimate the size of the light spot on the Moon surface. (The Earth-to-Moon distance is 370,000 km.)
3. French 8-14.
4. An ultrasound wave propagates in air along a narrow hallway with little decay. When a screen of a certain thickness is placed across the hallway, the intensity of the passing wave strongly decreases. But when the thickness of the screen is doubled, the ultrasound passes again with little decay.
  - a. Explain the phenomenon
  - b. Find the thickness of the screen in both cases if the ultrasound frequency is 1 MHz and the speed of sound inside the material of the screen is 5 km/sec.  
*Hint:* think of an optical analogue that decreases the intensity of the passing wave.
5. French 8-15
6. A plane passes directly overhead at an altitude  $h$ , and a sonic boom is heard at a time  $T$  later. Find the speed of the plane.