Reminders 4-15-08:

-Conceptual Questions on Geometrical Optics due Today.

-Read Chapter 24 and 25

-Exam 4 Thursday Chapters 22-25

Objectives:

-Interference and Young's Experiment

-Diffraction

Reminders 3-27-08:

-Chapter 20 homework due Tonight

-Exam 3 April 1

-Read 21.8-21.13

-Lens Lab Has Been Changed

Objectives:

-Properties of Electromagnetic Waves

-Electromagnetic Spectrum

-Nature of Light

-Doppler Effect for Light

- An object is placed 4.0cm to the left of a double convex lens of focal length f=12.0cm. Determine the location of the image. Is it real?
- A second lens of focal length f_2=6.0cm is placed 12.0cm to the right of the first lens. Determine the location of the image. Is it real? Draw a ray tracing diagram of the system.

q

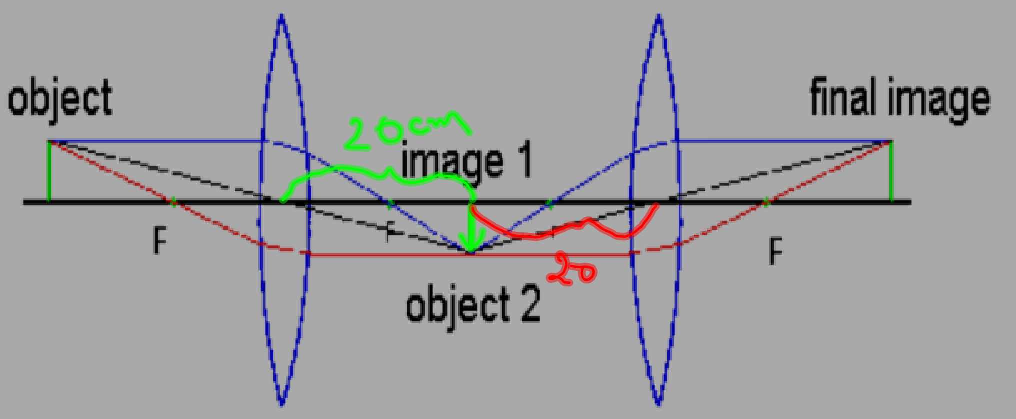
$$\frac{1}{S_i} = \frac{1}{f} - \frac{1}{S_o} = \frac{1}{12} - \frac{1}{4} = \frac{1}{12} - \frac{3}{12} = \frac{-2}{12}$$

$S_i = -6cm$

Lens 2

$$\frac{1}{S_i} = \frac{1}{6} - \frac{1}{18} = \frac{3}{18} - \frac{1}{18} = \frac{2}{18} \Rightarrow S_i = 9cm$$

Ray Diagram for Lens Combination



Can you derive an equation for the effective focal length of the lens combination? What is s_i if f_1=10cm, f_2=15cm, d=40cm, and s_o=20cm?

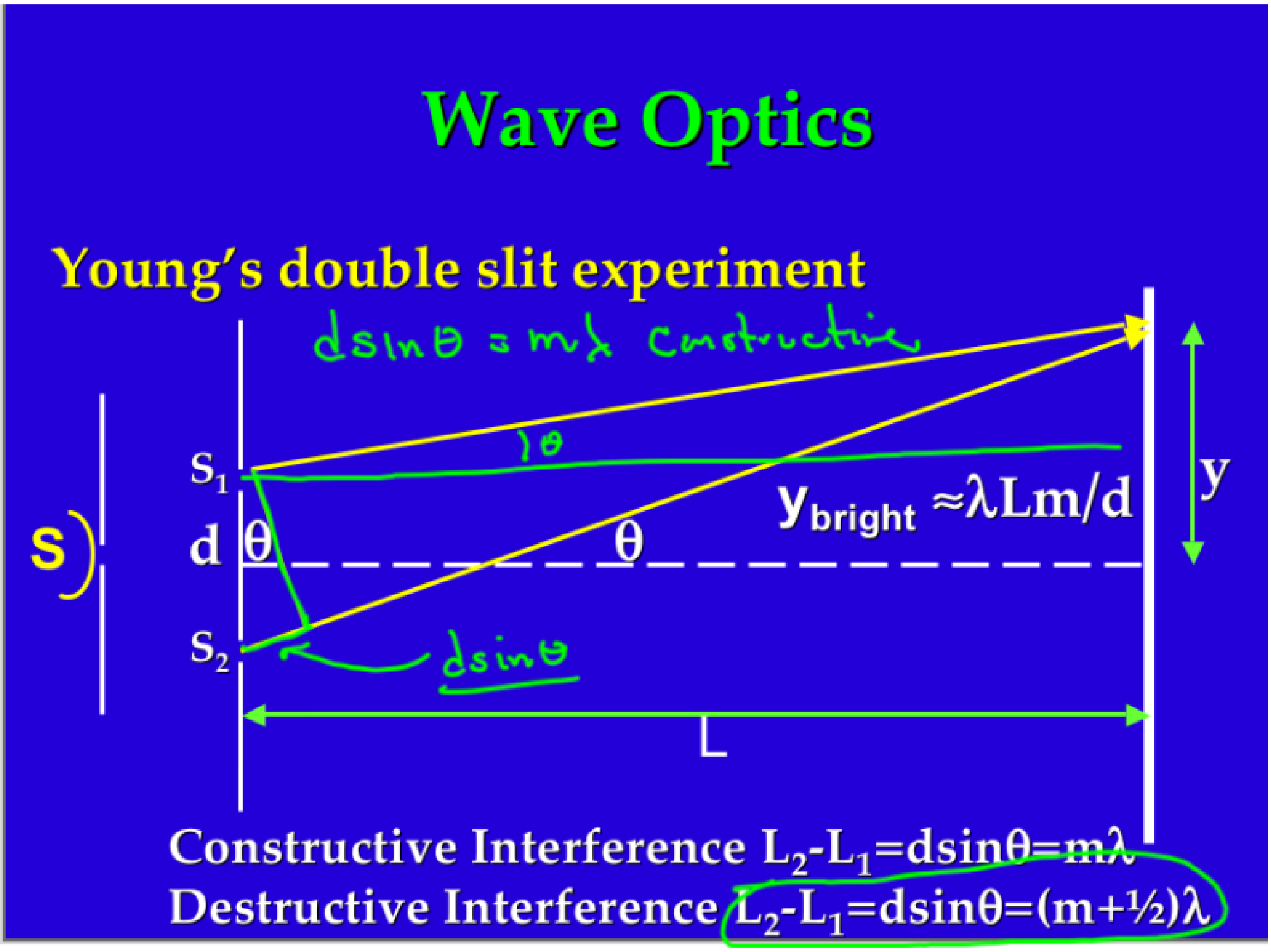
$$\frac{1}{s_o} + \frac{1}{s_i} = \frac{1}{f} \qquad \frac{1}{s_i} = \frac{1}{f_1} - \frac{1}{s_o} = \frac{1}{10} - \frac{1}{20}$$

$$s_i = 20$$

$$\frac{1}{s_{i_f}} = \frac{1}{f_2} - \frac{1}{s_{o_2}} = \frac{1}{15} - \frac{1}{20} = \frac{4}{60} - \frac{3}{60} = \frac{1}{60}$$

$s_{i_f} = 60$ cm from 2nd lens

$$M_T = M_1 M_2 = \left(-\frac{20}{20}\right)\left(-\frac{60}{20}\right) = 3$$


Wave Optics
Young's double slit experiment
dsinθ = mλ constructive
θ
S1
S
d θ
θ
S2
dsinθ
y
ybright ≈λLm/d
L
Constructive Interference L2-L1=dsinθ=mλ
Destructive Interference L2-L1=dsinθ=(m+½)λ

Wave Optics

- Red light from a He-Ne laser (λ =632.8nm)is incident on two narrow slits separated by 0.200mm. A fringe pattern is observed on a white sheet of paper held 1.00m away How far above and below the central axis do the first dark minima (minimum intensity) occur? Where is the 5th order bright fringe.

Answer: ±1.58mm;15.8mm

Wave Optics

- A telescope lens with an index of refraction of 1.55 is to be coated with a MgF_2 (n=1.38) to increase the transmission of yellow light (λ =550nm). What is the minimum thickness of the coating? (Hint: the goal is to minimize reflection to maximize transmission)

Answer: 99.6nm

Apr 7-12:32 PM

Wave Optics

- A beam of vertically polarized light is incident on 3 polaroid films. The transmission axis of the 1st polarizer is at 0 degrees with respect to the vertical,the 2nd is at 40.0° with respect the the vertical, and the 3rd is at 75.0° with respect to the vertical. What percent of the incident light is transmitted through all three polaroids?

Answer: $I=0.39I_o$;39%; 19.5% if incident light is unpolarized