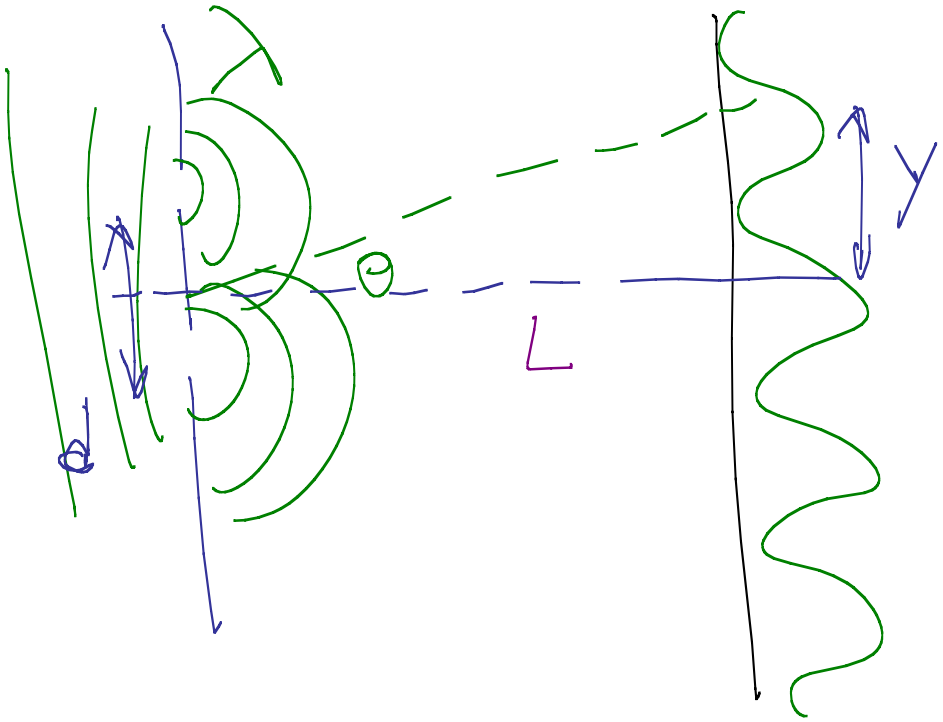
Phys 2120-4 11/26/12

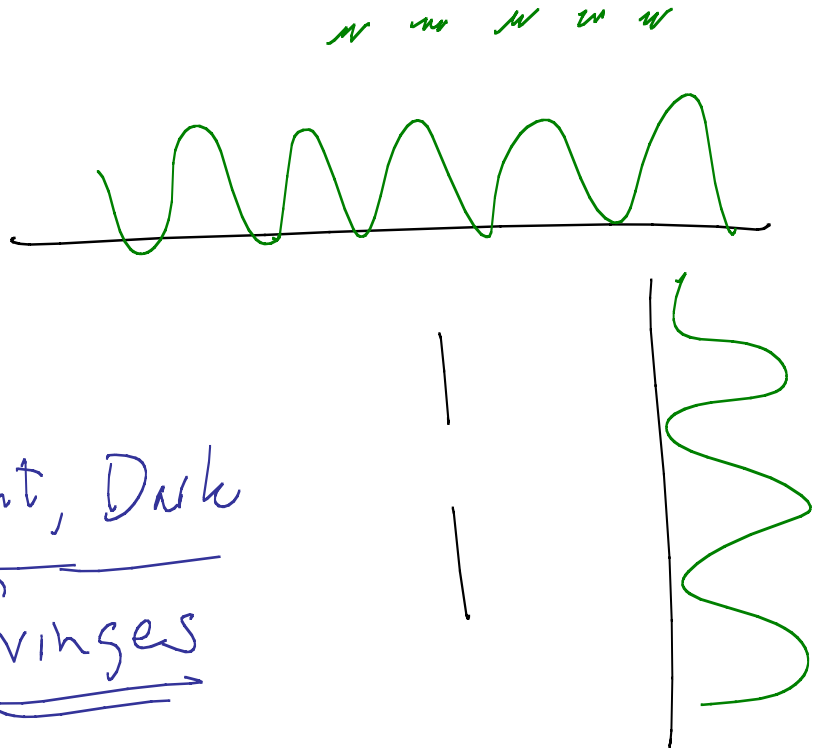
Note Title 11/26/2012

Ch 32 Interference
Diffraction

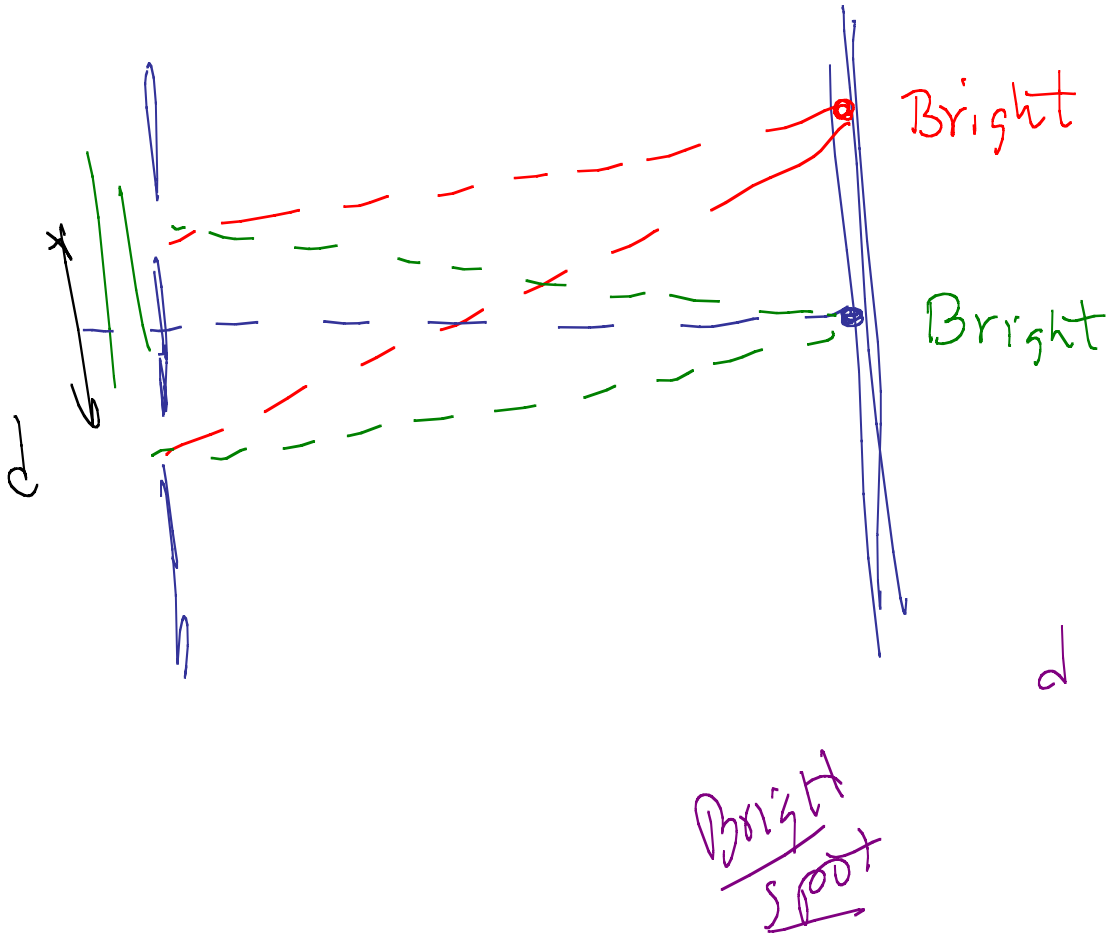
Two slit expt. Light source coherent
Monochromatic.

Lasers.

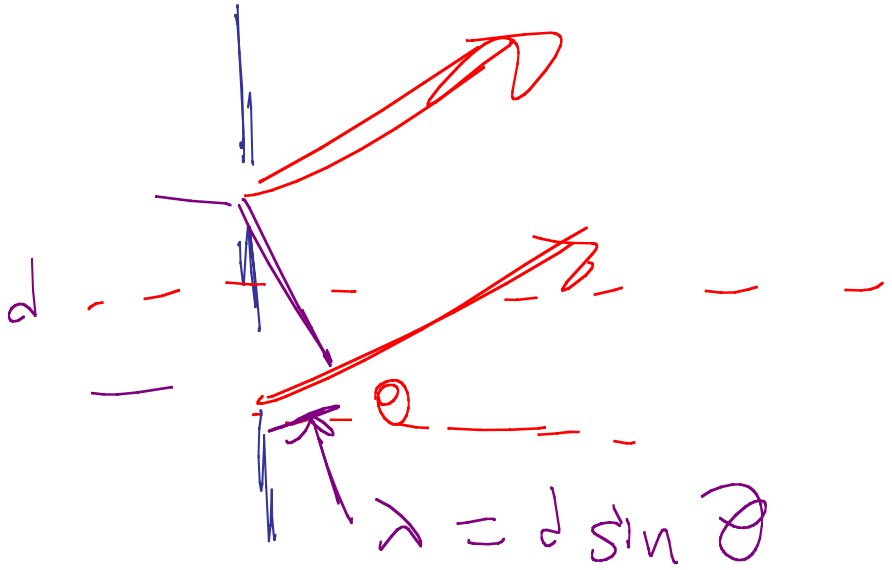


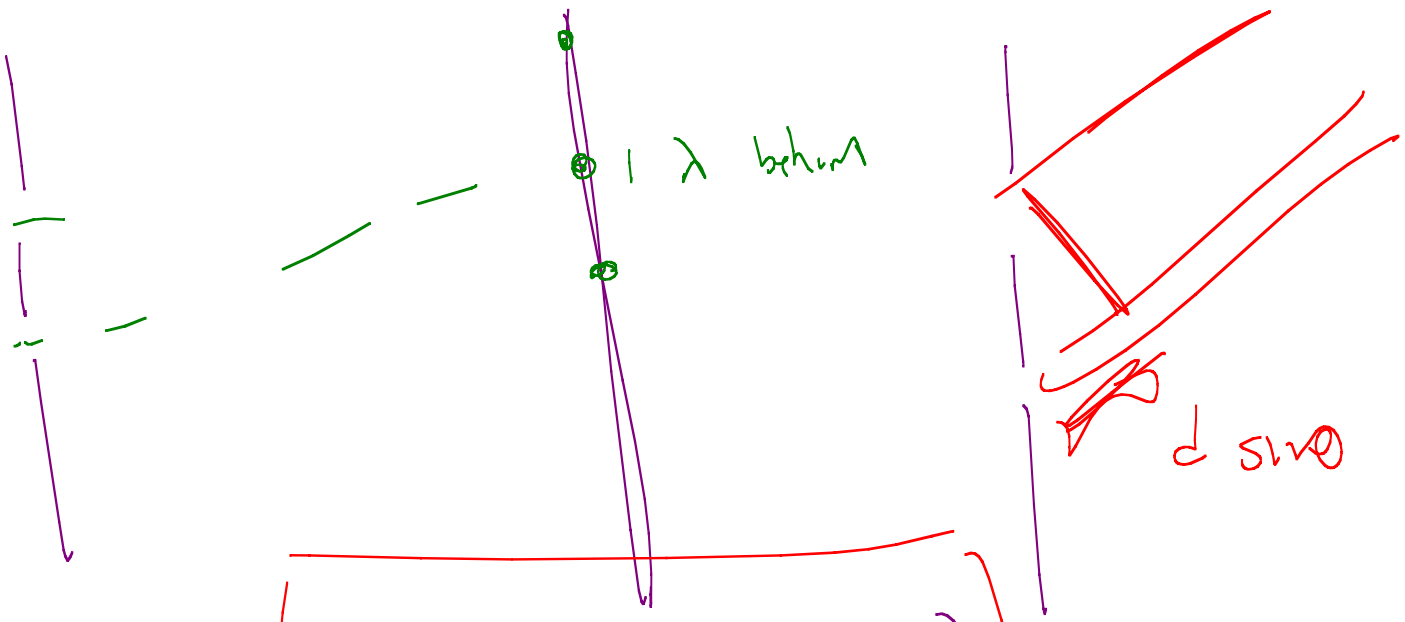


Bright, Dark fringes



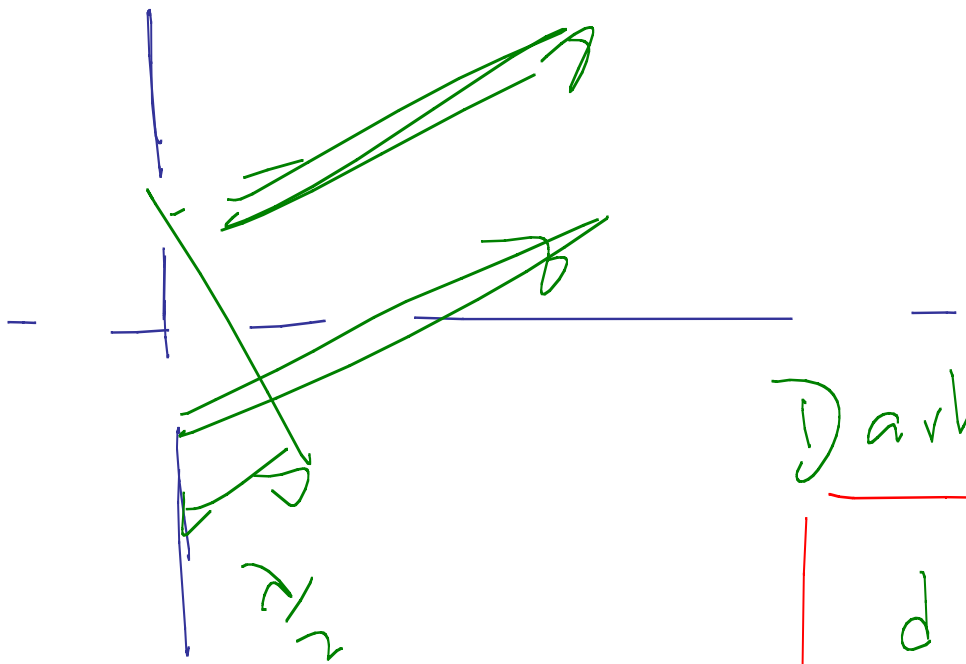
One wave is a full wavelength behind the other





If $d \sin\theta = m\lambda$ $m = 0, 1, 2, \ldots$

constructive interf., bright



If $d \sin\theta = \frac{\lambda}{2}$ dark

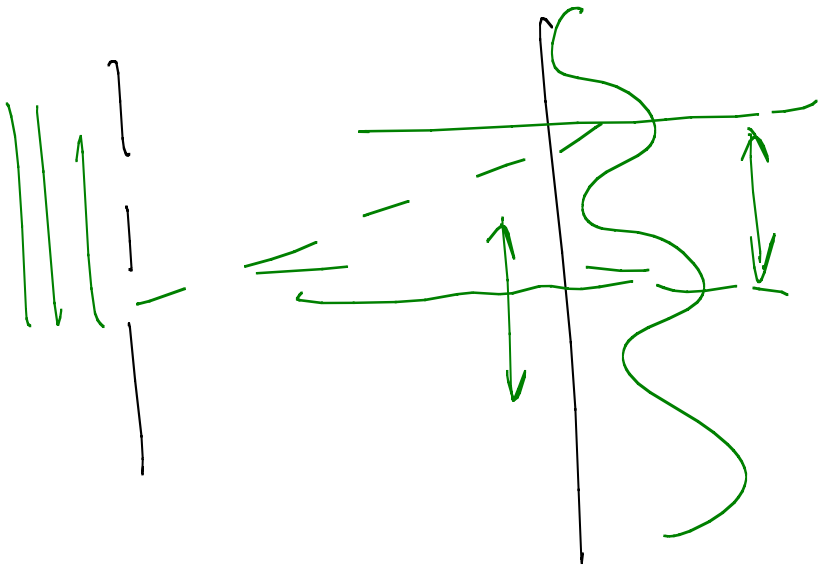
$\frac{3\lambda}{2}$

etc.

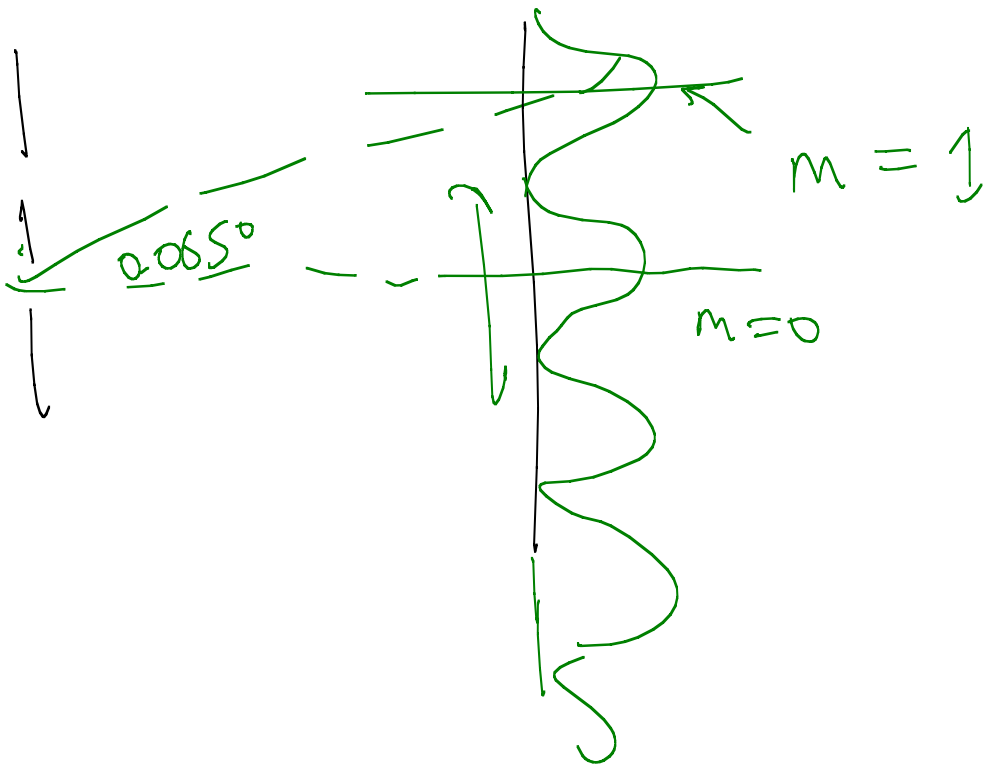
Dark fringe where

$$d \sin\theta = \left(m + \frac{1}{2}\right)\lambda$$

$m = 0, 1, 2, 3, \ldots$



32.13 The interference pattern from two slits sep'd by 0.39 mm has bright fringes w/ angular spacing 0.065°. Fnd light's wavelength



$$d \sin\theta = (1)\lambda$$

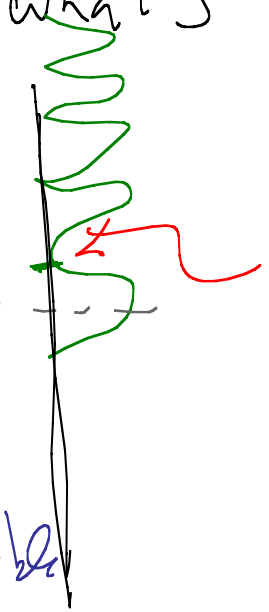
$$\lambda = d \sin\theta$$

$$= (0.37\ mm)\sin(0.065)$$

$$\lambda = 4.20 \times 10^{-7}\ m$$

$$= 420\ nm$$

32.14 The 546-nm green line fall on double-slit expt. If fifth dark fringe is at 0.113° from centerline what's the slit separation



$d \sin\theta = (m+\frac{1}{2})\lambda$

$m = 0$

$m = 4$

$m = 5$

So

$d \sin\theta = (5+\frac{1}{2})\lambda$

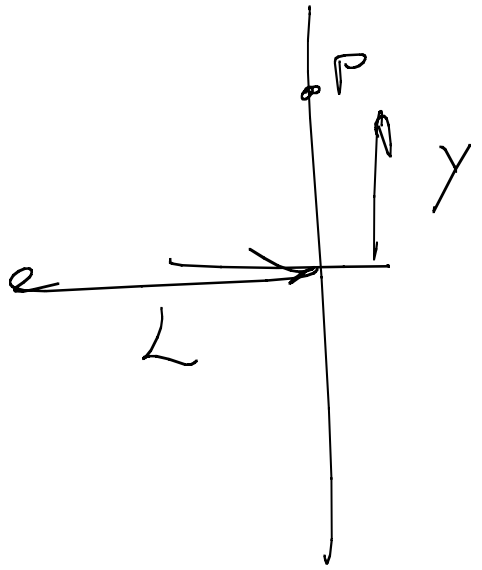
$\Rightarrow d = 1.52 \times 10^{-3}$ m

$= 1.52$ mm plausible

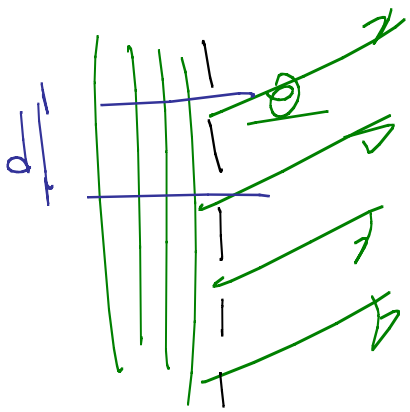
a it.

What about between the fringes

$$\rightarrow \quad \bar{S} = 4\bar{S}_0 \cos^2\left(\frac{\pi d y}{\lambda L}\right)$$



Multiple slits, sep'd by d



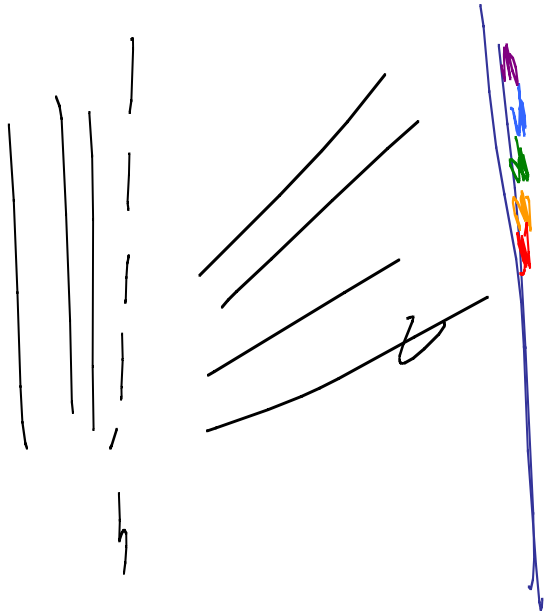
N slits

Max: $d \sin\theta = m\lambda$ $\quad m = 0, 1, 2, \ldots$

Min occur $\quad d\sin\theta = \frac{m}{N}\lambda$ $\quad$ m integer not mult. of N

Large # slits ⟶ "Diffraction grating"

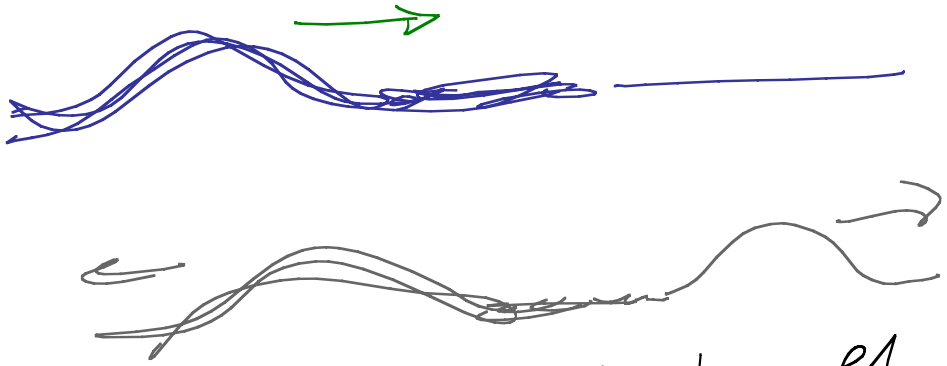
Transmission grating



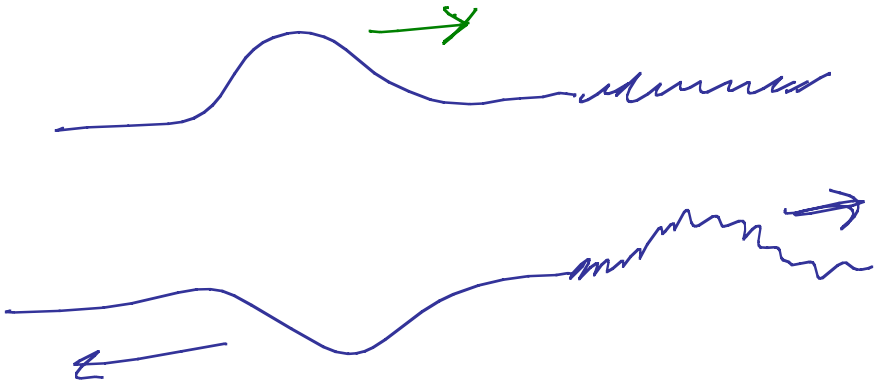
$N \to \infty$ p. 569

only maxima

Reflected waves

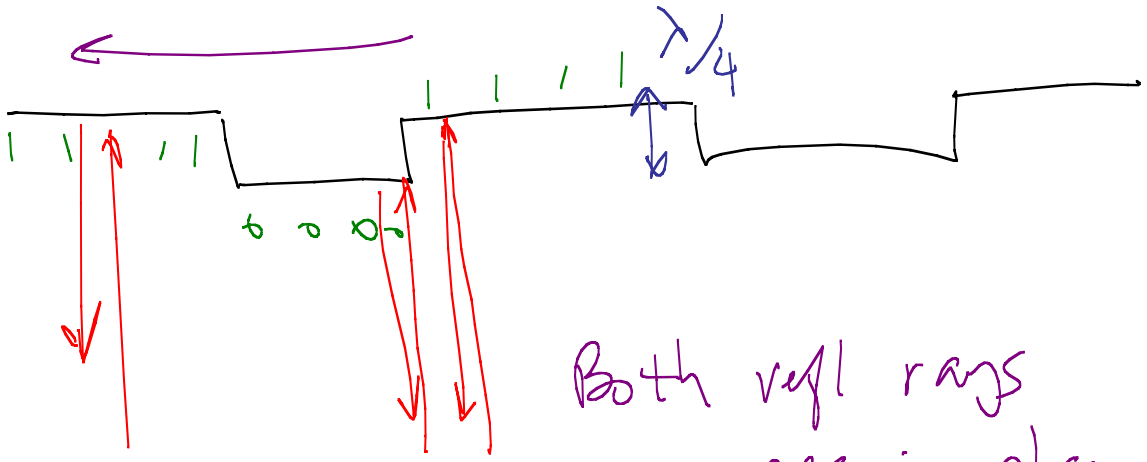


When wave reflects off "thicker" medium, reflects negative



Reflected wave goes neg.

CD's



Both refl rays go neg in phase

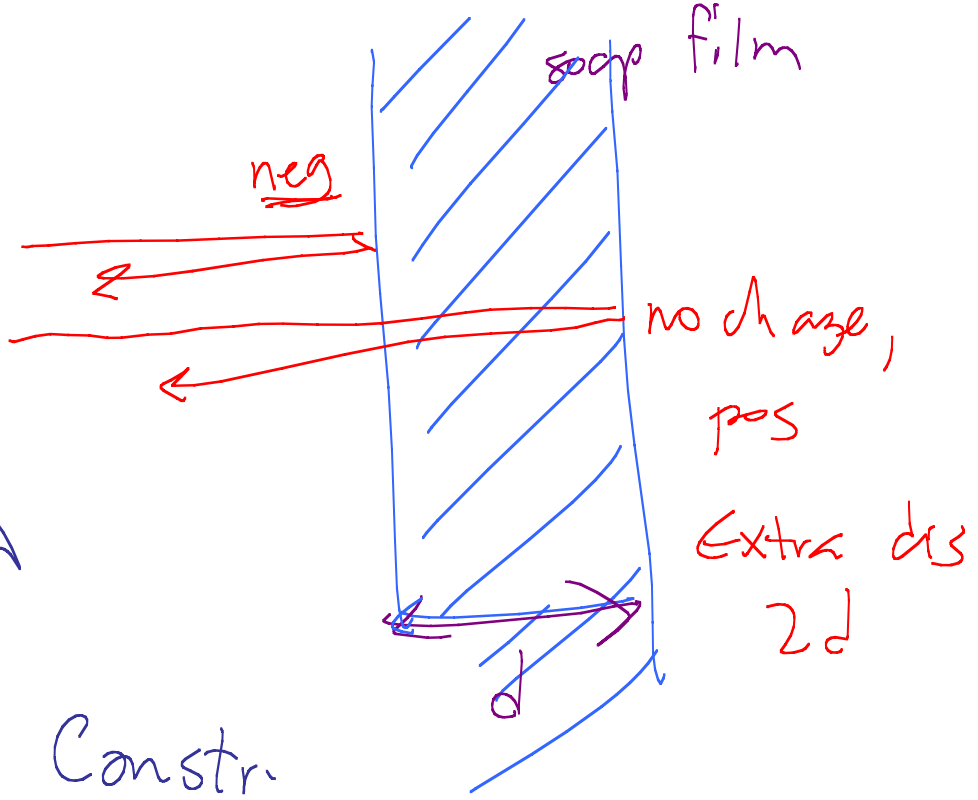
Diff in paths = $\lambda/2$

Destr. interference

CD → digital infor

Thin films

$$\lambda_{soap} = \frac{\lambda_{air}}{n}$$



Suppose $2d = \text{full.}\ \lambda = m\lambda$

$= \text{Destruc.}$

$2d = (m+\frac{1}{2})\lambda$ Constr.