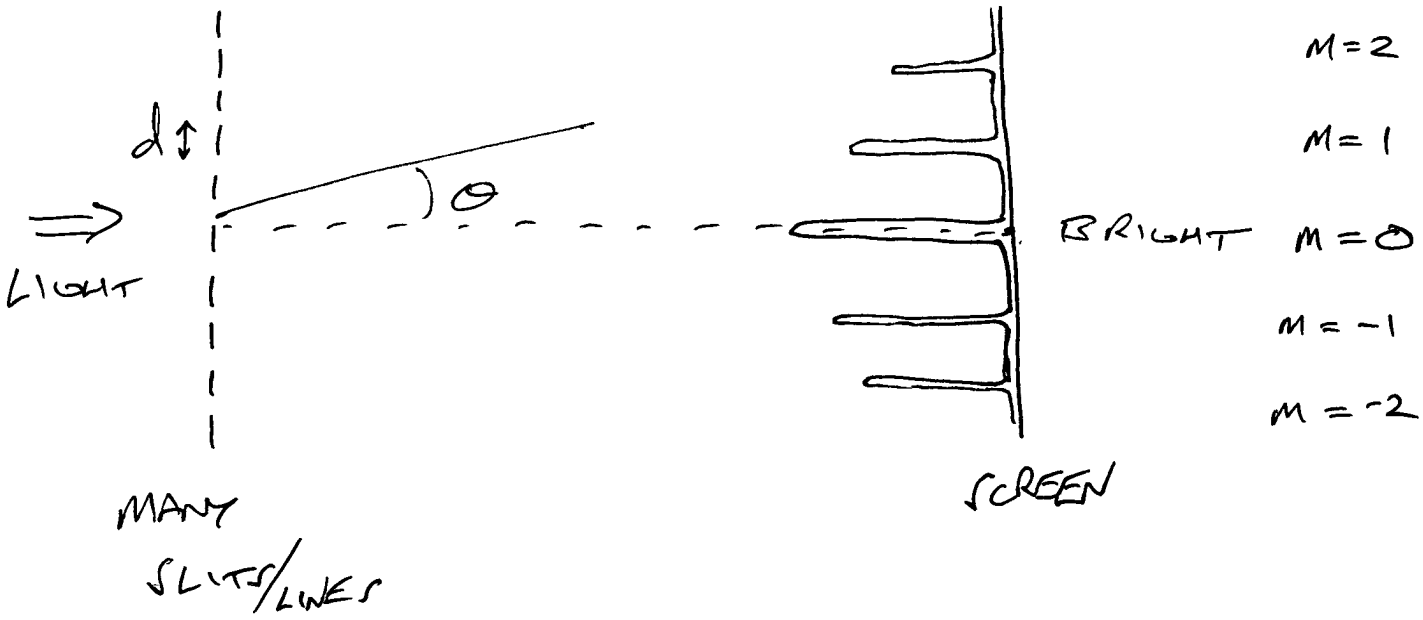
2012 APR 2



# DIFFRACTION GRATINGS

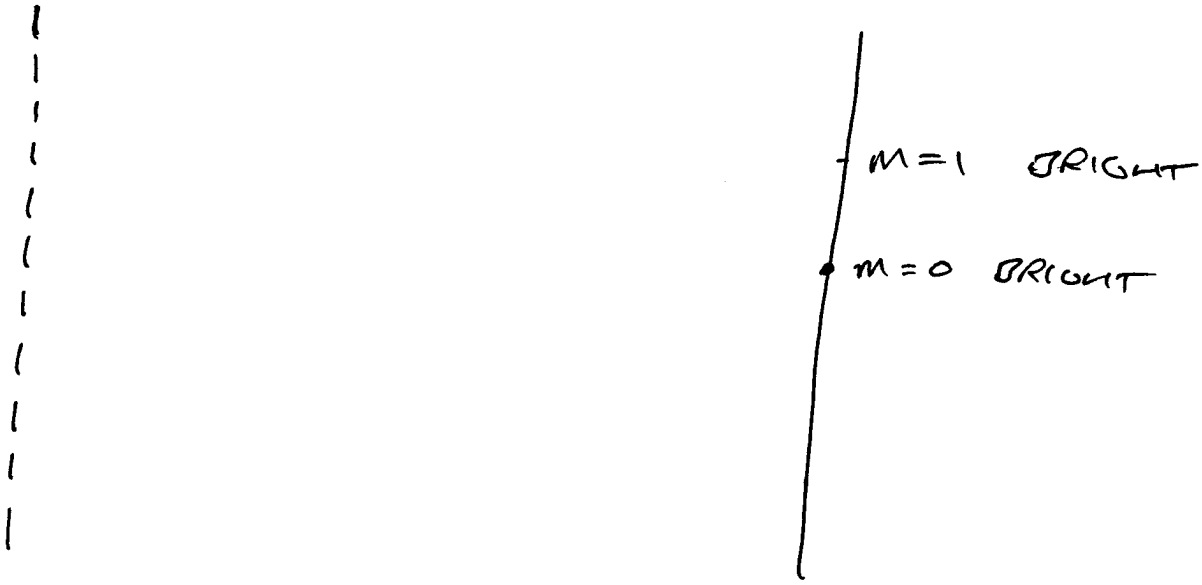



$d$ = DISTANCE BETWEEN NEIGHBORING SLITS/LINES

BRIGHT LINES (PEAKS) OCCURS WHEN

$$\frac{d \sin\theta}{\lambda} = m \leftarrow \text{INTEGER}$$

# WHY ARE THERE SHARP LINES SURROUNDED BY LARGE DARK AREAS?




AT EACH BRIGHT SPOT,

ALL OF THE SOURCES OF LIGHT

ARE CONSTRUCTIVELY INTERFERING.

IF YOU'RE ANYWHERE ELSE (BESIDES A BRIGHT LINE), YOU CAN FIND PAIRS THAT DESTRUCTIVELY INTERFERE.

SUMMARY: THERE ARE MANY WAYS TO ACHIEVE DESTRUCTIVE INTERFERENCE.

(GG, Ch 24, P 28)



$$\frac{d \sin\theta}{\lambda} = m$$

3500 LINES/cm

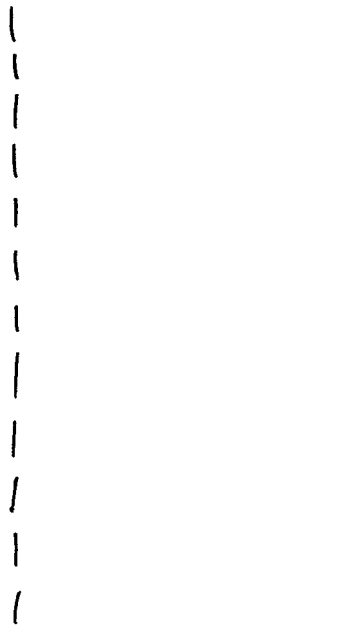
$$d = \frac{1\,cm}{3500} \times \frac{1\,m}{100\,cm} \times \frac{1\,nm}{10^{-9}\,m}$$

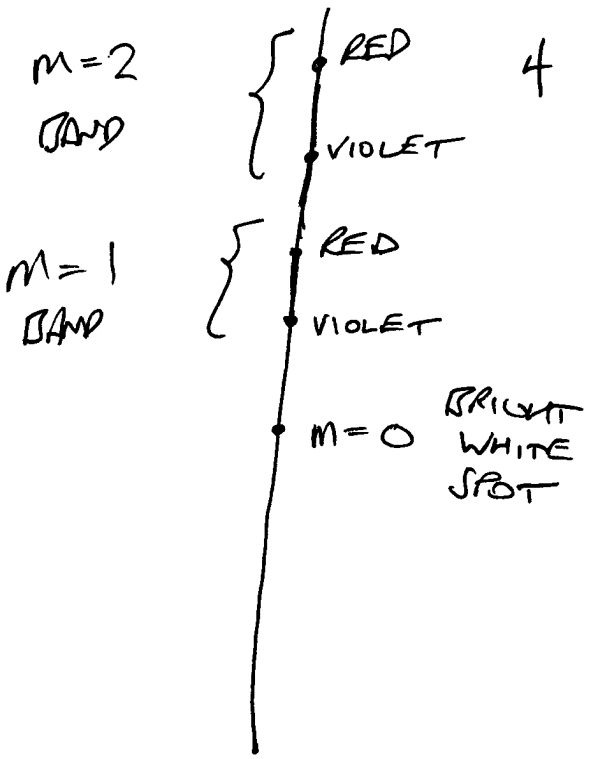
$$= \frac{1\,nm}{3.5 \times 10^{-4}}$$

$$\frac{(1\,nm)(\sin 28^\circ)}{(3.5 \times 10^{-4})\ \lambda} = 3$$

$$\lambda = \frac{\sin 28^\circ}{3(3.5 \times 10^{-4})}\ nm$$

$$= 447\ nm$$




$$\frac{d \sin\theta}{\lambda} = m$$

FOR $m=1$,

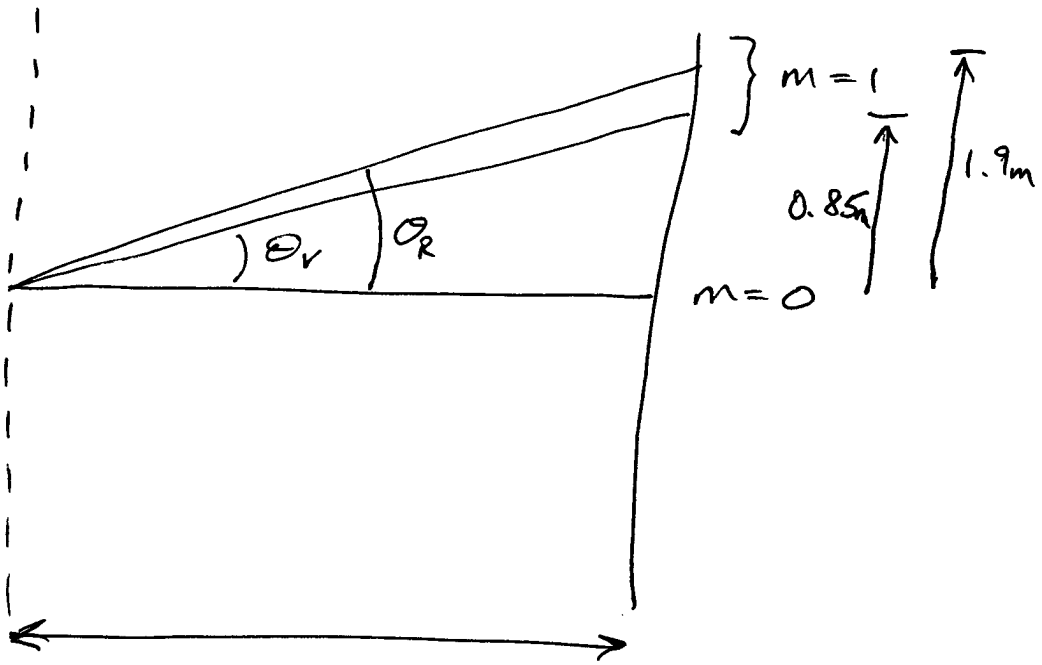
$$\sin\theta = \frac{\lambda}{d}$$

FOR $m=2$,

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

(GG, Ch 24, P36)






$$\frac{d \sin\theta}{\lambda} = m \qquad \frac{d \sin\theta_R}{\lambda_R} = 1 \qquad \frac{d \sin\theta_v}{\lambda_v} = 1$$

$$\sin\theta_R = \frac{\lambda_R}{d} = \frac{(750\,nm)(8500)}{1\,cm} = (0.75)(0.85)$$

$$\theta_R = 39.6^\circ$$

$$\tan 39.6^\circ = \frac{Y_R}{L} \Rightarrow Y_R = 1.9_m$$

$$\sin\theta_v = \frac{(410\,nm)(8500)}{1\,cm} = (0.41)(0.85)$$

$$\theta_v = 20.4^\circ$$

$$\tan 20.4^\circ = \frac{Y_v}{L} \Rightarrow Y_v = 0.85_m$$

$$\text{WIDTH} = 1.9_m - 0.85_m = 1.05_m$$