7-4

Irradiance $\propto E^2$ $\qquad E_{02} = \sqrt{N}\, E_{01}$

$$= \sum_{i=1}^{N} E_{0i}^2 + 2 \sum_{j>i}^{N} \sum_{i=1}^{N} E_{0i} E_{0j} \cos(\underbrace{\alpha_j - \alpha_i}_{\Delta\phi})$$

$$I(\Delta\phi) = E_{01}^2 + N E_{01}^2 + 2\sqrt{N} E_{01}^2 \cos(\Delta\phi)$$

Fringe visibility:

$$\frac{I(0) - I(\pi)}{I(0) + I(\pi)} = \frac{4\sqrt{N} E_{01}^2}{(2N+2) E_{01}^2} = \frac{2\sqrt{N}}{N+1}$$

7-7

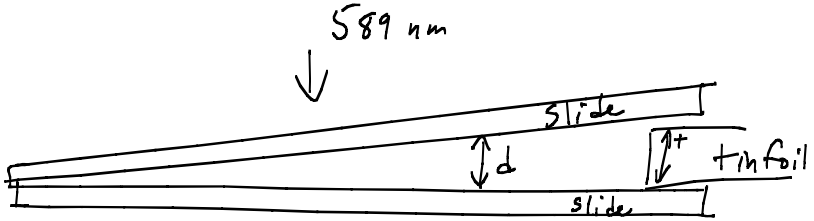
From lecture 8:

$$I(x) = I_0 \left(1 + \cos \frac{kxd}{L}\right) \qquad \frac{kxd}{L} = 0, 2\pi, \ldots 2m\pi \qquad \text{"constructive"}$$

$$x = \frac{2m\pi L}{kd} = \frac{mL\lambda}{d}$$

So $\quad \lambda = \dfrac{xd}{mL} = \dfrac{(3.473\ \text{cm})(0.02\ \text{cm})}{9 \cdot 150\ \text{cm}} = 5.14 \times 10^{-5} = 514\ \text{nm}$

7-20



Bright fringes from constructive interference when d is an integer multiple of $\frac{\lambda}{2}$, so 40 fringes corresponds to $t = 20 \cdot \lambda = 11.78\ \mu m$

8-1

fringe spacing $= \frac{114\ \mu m}{523} = 218\ nm = \frac{\lambda}{2}$ so $\lambda = 436\ nm$

8-3

$\phi_0 = kx$

$\phi_{sheet} = nkx$

$\Delta\phi = (n-1)kx = 35 \cdot 2\pi$, so $x = \frac{35\lambda}{n-1} = 47.5\ \mu m$

8-5

(a) See 8-3: $\Delta\phi = (n-1)kx$ so $n = \frac{\Delta\phi}{kx} + 1 = \frac{N \cdot 2\pi}{\frac{2\pi}{\lambda} L} + 1 = \frac{N\lambda}{L} + 1$

(b) $\#\text{ fringes} = \frac{\Delta\phi}{2\pi} = \frac{(n-1)L}{\lambda} = \frac{4.5\times10^{-4} \cdot 10}{589\times10^{-7}} = 76.4$

diagram

modified Michelson; light takes 2 round trips through each arm before combining due to corner cubes.