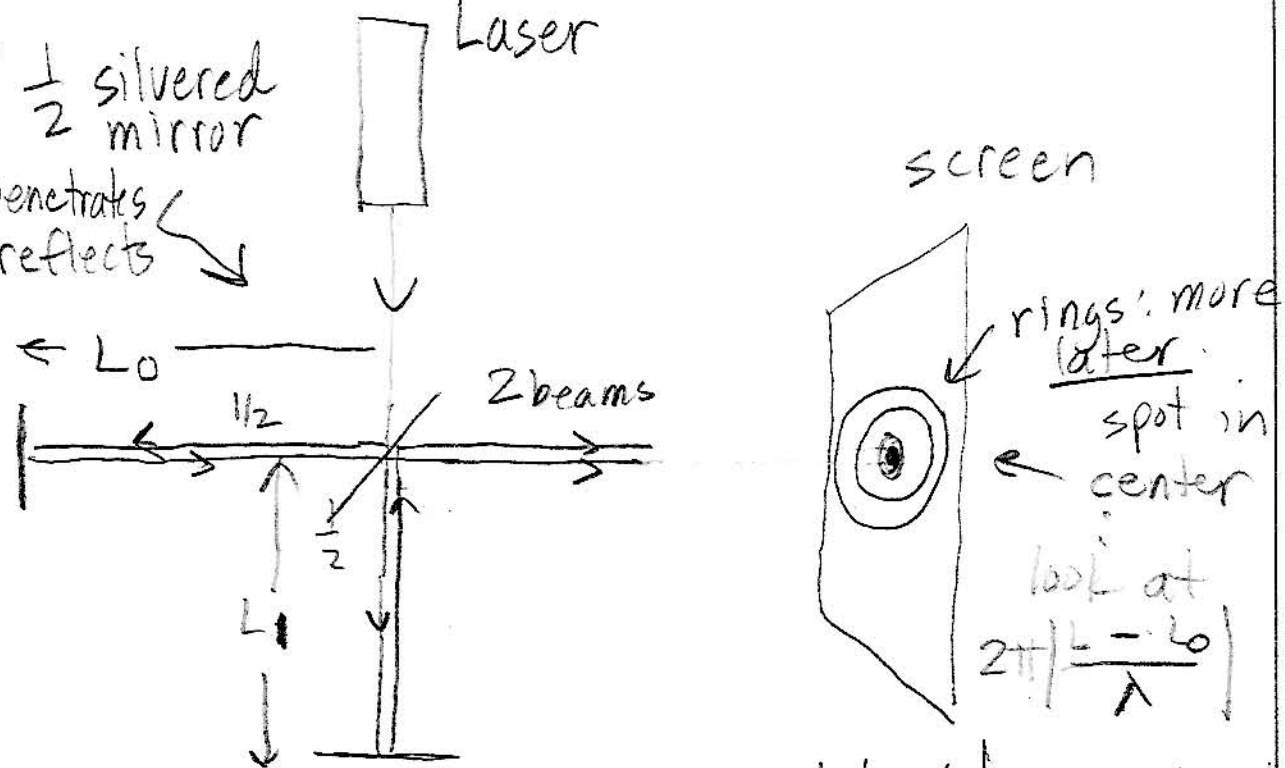
Michelson Interferometer

Shown in class

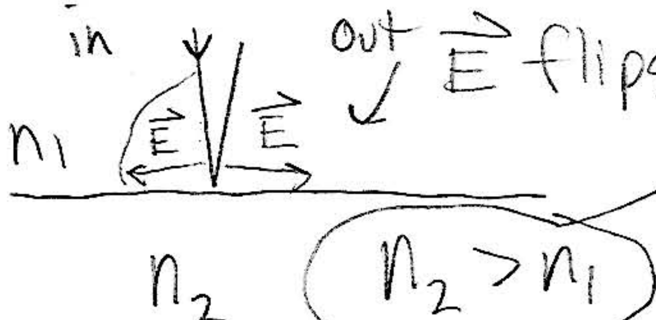


vary L_1

$$\phi = 2\pi \left| \frac{L_1 - L_0}{\lambda} \right| = 0 \text{ bright}$$
$$= \pi \text{ dark}$$
$$= 2\pi \text{ bright}$$

Thin films

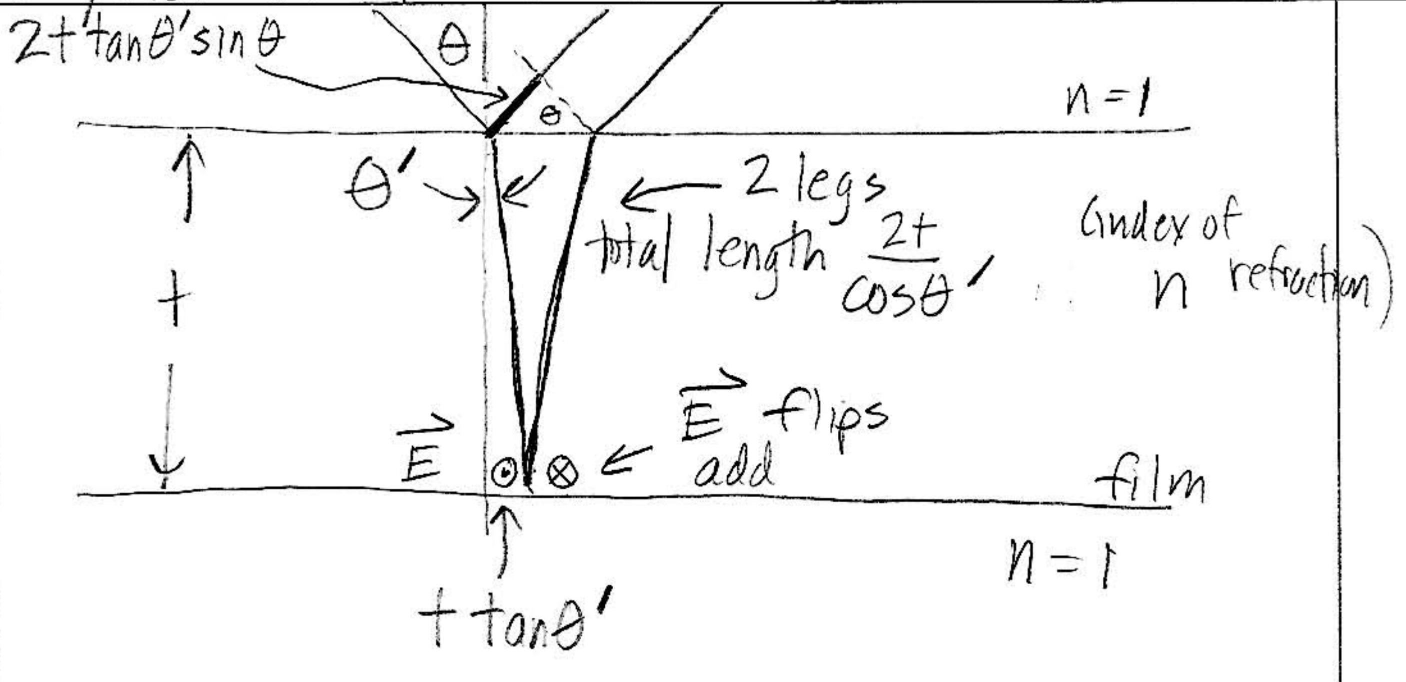
A fact (no proof!)



$\vec{E}$ flips, when like phase shift of π

Why? like rope pulse reflection at a wall

when $n_2 < n_1$, no flip ...



Total phase difference between paths : phase of reflection off top − phase of journey to bottom + its reflection

$$\phi = \frac{2\pi}{\lambda_0} \cdot 2t \cdot \tan\theta' \sin\theta - \frac{2\pi}{\lambda} \cdot \frac{2t}{\cos\theta'} - \pi$$

wavelength in vacuum

wavelength in film, $= \frac{\lambda_0}{n}$

snell $= n \sin\theta'$

$$\phi = \frac{4\pi t}{\lambda_0} \cdot \left[\tan\theta' \sin\theta - \frac{n}{\cos\theta'} \right] - \pi$$

$$\left[n \frac{\sin^2\theta'}{\cos\theta'} - \frac{n}{\cos\theta} \right]$$

$$-n \left[\frac{1 - \sin^2\theta'}{\cos\theta'} \right]$$

$$\phi = -\frac{4\pi n t}{\lambda_0}\cos\theta' - \pi$$

and so,

$$I(\theta') \propto \cos^2\frac{\phi}{2} = \cos^2\left[-\frac{2\pi n t}{\lambda_0}\cos\theta' - \frac{\pi}{2}\right]$$

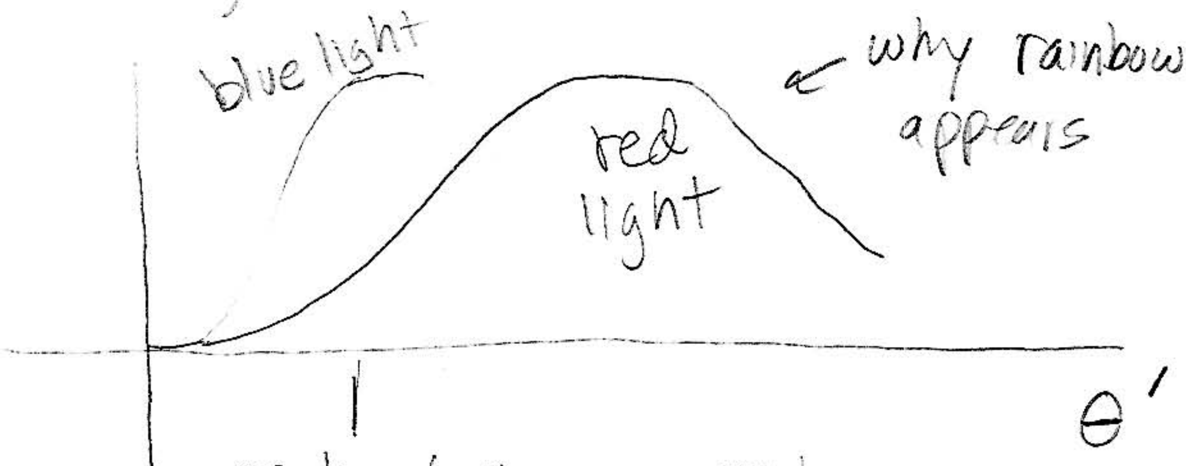
↑

$\sin\theta' = \frac{1}{n}\sin\theta$

Main Points: $t \to 0$, $I(\theta') \to 0$!

Reflection off a very thin refracting layer is 0! This is how anti glare coatings work. Physical basis is: reflection off of one surface has its field reversed.

$t > 0$, $I(\theta') \to$ interference.



$\frac{2\pi n t}{\lambda_0}\cos\theta' = \frac{\pi}{2}$, $\cos\theta' = \frac{\pi n t}{4\lambda_0}$