

Quiz #4

NAME:

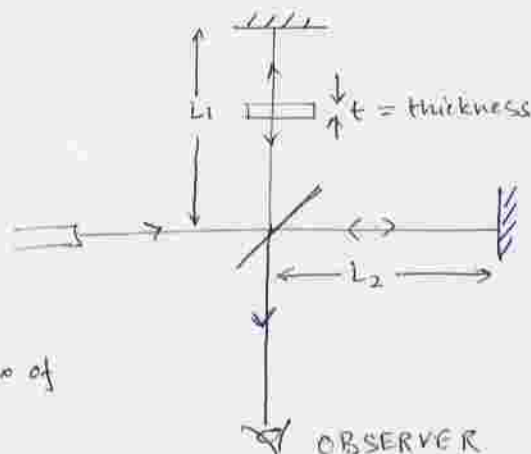
Quiz #3a:

Phys270

Section 0102

SOLUTION

1. [10 pts] A 0.50-mm-thick piece of glass is inserted into one arm of a Michelson interferometer that is using light of wavelength 600nm. This causes the fringe pattern to shift by 500 fringes. What is the index of refraction of the piece of glass?



n = refractive index of plate.

n.i. of air = 1.

In the absence of plate

$$\Delta L = |2L_1 - 2L_2| = \text{path difference.}$$

Let plate thickness be t

now

$$\Delta L = |2(L_1 - t) + 2nt - 2L_2|$$

$$= |2L_1 - 2L_2 + 2(n-1)t|$$

$$= |2L_1 - 2L_2| \pm 2(n-1)t$$

depending on whether $L_1 > L_2$ or $L_2 > L_1$

However, $2(n-1)t = 500 \lambda$ [for our problem]

$$\therefore n-1 = \frac{500 \lambda}{2t}$$

$$n = 1 + \frac{500 \lambda}{2t} = 1 + \frac{500 \times 600 \times 10^{-9}}{2 \times 0.5 \times 10^{-3}} = 1 + \frac{3 \times 10^5 \times 10^{-9}}{10^3} = 1.3$$

$$n = 1.3$$