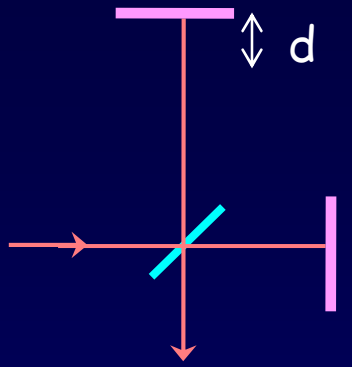
Solution

Consider the following Michelson interferometer. Suppose that for the setup shown, all the light (with λ = 500 nm) comes out the bottom port.



1. How much does the top mirror need to be moved so that none of the light comes out the bottom port?

a. 125 nm b. 250 nm c. 500 nm

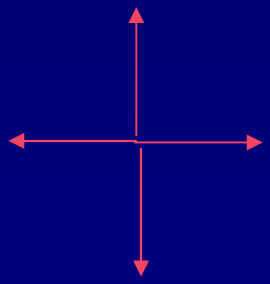
We need to go from complete constructive to complete destructive interference → $\Delta\phi = 180^\circ$ → $\delta = \lambda/2$.

However…when we move the mirror by d, we change δ by 2d.

Therefore, $d = \delta/2 = \lambda/4 = 500/4 = 125$ nm.

2. Where does the light then go?

a. down b. up c. left d. right



The light goes out the way it came in.
Energy is conserved --the light can't just disappear!

The Michelson interferometer is perhaps most famous for disproving the hypothesis that EM waves propagate through an "aether" – this result helped stimulate the Special Theory of Relativity