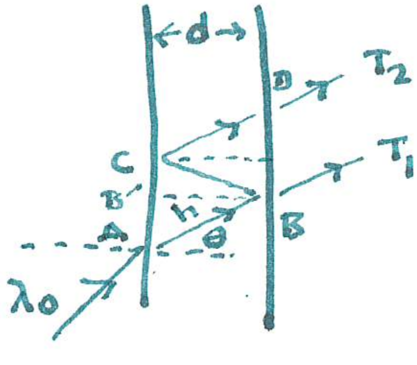
A note on planar Fabry - Perot Etalons

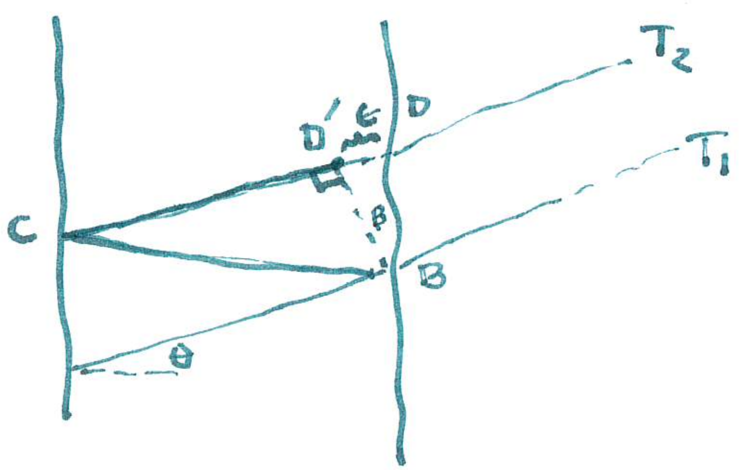


One sees the formula for the ~~the~~ accumulated phase shift between succesive (adjacent) transmitted rays through a planar Fabry-Perot etalon

$$\Delta\varphi = \frac{2\pi\,\delta\ell}{\lambda} = \frac{2\pi n}{\lambda_0}\, 2d\cos\theta, \qquad (1)$$

and it is maddening because the hypotenuse of the little triangle ($\Delta BB'$) is $d/\cos\theta$.

It helps to recognise that the actual path length difference (yes, I know, it looks like $2d/\cos\theta$) is actually measured normal to the parallel paths (T_1 & T_2) as pictured below,



$$\delta\ell = \overline{BC} + \overline{CD'}. \qquad (2)$$

But that's

$$\delta\ell = \frac{2d}{\cos\theta} - \epsilon \qquad (3)$$

$$= \frac{2d}{\cos\theta} - \overline{BD}\cdot\sin\beta, \quad (4)$$

not very promising.

Except that $\beta = \theta$, and $\overline{BD} = 2 \times \frac{d}{\cos\theta} \cdot \sin\theta$. To see this, see below and $\delta\ell$ from (4) simplifies

$$\frac{\overline{DB}}{2} = \sin\theta \cdot \frac{d}{\cos\theta}$$

to $\delta\ell = \frac{2d}{\cos\theta} - 2d\frac{\sin^2\theta}{\cos\theta} = 2d\frac{\cos^2\theta}{\cos\theta}$

$\therefore \Delta\phi = \frac{4\pi n}{\lambda_0} d\cos\theta$ ok that's (1)