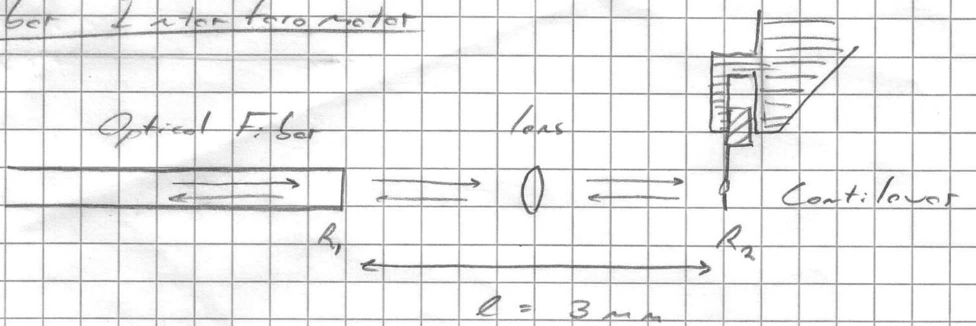
12. 10. 2009 #5

①

Fiber Interferometer



In the limit of low reflectivities & low finesse.

$R_1, R_2 << 1$

$$P_I = E_I^2$$

$$P_R = \left| E_I \sqrt{R_1}\, e^{i\phi_1} + E_I \sqrt{1-R_1}\sqrt{R_2}\sqrt{1-R_1}\, e^{i\phi_2} \right|^2$$

$$P_R = E_I^2 \left[R_1 + (1-R_1)^2 R_2 + 2\sqrt{R_1 R_2}\,(1-R_1)\cos(\phi_1 - \phi_2) \right]$$

$$P_R = E_I^2 \left[R_1 + (1-R_1)^2 R_2 + 2\sqrt{R_1 R_2}\,(1-R_1)\cos\left(\frac{4\pi l}{\lambda}\right) \right]$$

if $l = x_0 + x$

w/ $x_0 = \lambda\left(n + \frac{3}{8}\right)$

$$P_R = E_I^2 \left[R_1 + (1-R_1)^2 R_2 + 2\sqrt{R_1 R_2}\,(1-R_1)\sin\left(\frac{4\pi x}{\lambda}\right) \right]$$

if $x << \lambda$

&

$x = \sqrt{2}\, x_{rms} \sin(\omega_0 t)$

$$\therefore P_R \approx E_I^2 \left[R_1 + (1-R_1)^2 R_2 + \frac{8\pi\sqrt{R_1 R_2}\,(1-R_1)\sqrt{2}\, x_{rms}\sin(\omega_0 t)}{\lambda} \right]$$

Recall $R_1, R_2 << 1$

$$P_R \approx E_I^2 \left[R_1 + R_2 + \frac{8\pi}{\lambda}\sqrt{R_1 R_2}\,\sqrt{2}\, x_{rms}\sin(\omega_0 t) \right]$$