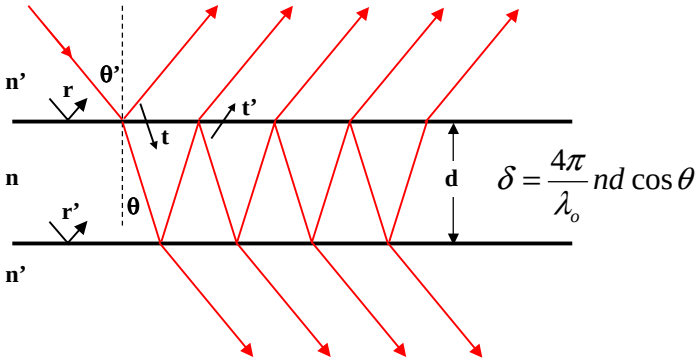
Part 5
Multiple Beam Interference

- **Fringe Shape**
- **Fabry-Perot Interferometer**
- **Central Spot Scanning**

Multiple Beam Interference

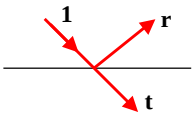


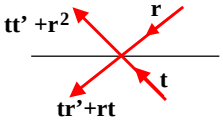
Reflected $r \quad tt'r'e^{i\delta} \quad tt'r'^3e^{2i\delta} \cdots \quad tt'r'^{2p-3}e^{i(p-1)\delta}$

Transmitted $tt' \quad tt'r'^2e^{i\delta} \quad tt'r'^4e^{2i\delta} \cdots \quad tt'r'^{2(p-1)}e^{i(p-1)\delta}$

Stokes Relations

If there are no losses a wave's propagation must be reversible.





Reversibility

$$tt'+r^2=1$$
$$tr'+rt=0$$
$$tt'=1-r^2$$
$$r=-r'$$

Stokes Relations

$$R+T=1 \qquad tt'=T \qquad \mathrm{R}=\mathrm{r}^2=r'^2$$

Irradiance of Reflected and Transmitted Beams

$$\frac{I_r}{I_i}=\frac{F\sin^2(\delta/2)}{1+F\sin^2(\delta/2)}$$

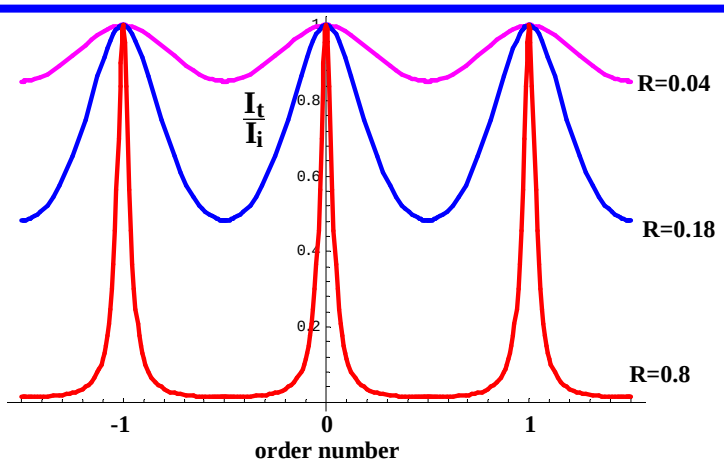
and

$$\frac{I_t}{I_i}=\frac{1}{1+F\sin^2(\delta/2)}$$

$$F\equiv\frac{4R}{(1-R)^2}=\text{ Coefficient of finesse}$$

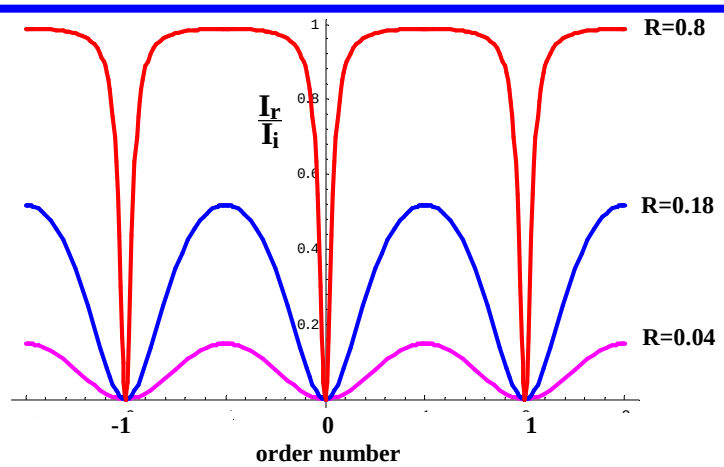
$$\delta=\frac{2\pi}{\lambda}2nd\cos\theta$$

Transmission Fringes



For maximum 2nd cos θ = mλ

Reflection Fringes



For minimum 2nd cos θ = mλ

Chromatic Resolving Power

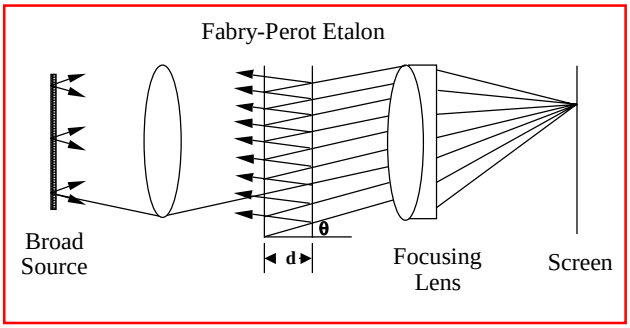
$$\Im = finesse = \frac{\text{separation of adjacent maximas}}{\text{width of half - max of fringes}} = \frac{\pi\sqrt{F}}{2} = \frac{\pi\sqrt{R}}{1-R}$$

$$\Re = \text{chromatic resolving power} = \frac{\lambda}{\Delta\lambda_{\min}} = \Im\frac{2nd}{\lambda} = \Im m$$

$$\Delta\lambda_{FSR} = \frac{\lambda^2}{2nd}$$

$$\frac{\Delta\lambda_{FSR}}{\Delta\lambda_{\min}} = \Im$$

Fabry-Perot Interferometer



Central Spot Scanning