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$$\phi_1 = k_s \ell_1 + 0$$
$$\phi_2 = k_s \ell_1 + k_a 2\Delta y + \pi$$

$$\Delta\phi = \frac{2\pi}{\lambda}(2\Delta y) + \pi \qquad \text{want } \Delta\phi = 2\pi n$$

$$R^2 = r^2 + y^2 = r^2 + (R-\Delta y)^2$$

$$\Delta y \simeq R - y$$

binomial expansion

$$r^2 = R^2 - R^2\left(1 - \frac{\Delta y}{R}\right)^2 \simeq R^2 - R^2\left(1 - \frac{2\Delta y}{R} + \dots\right)$$

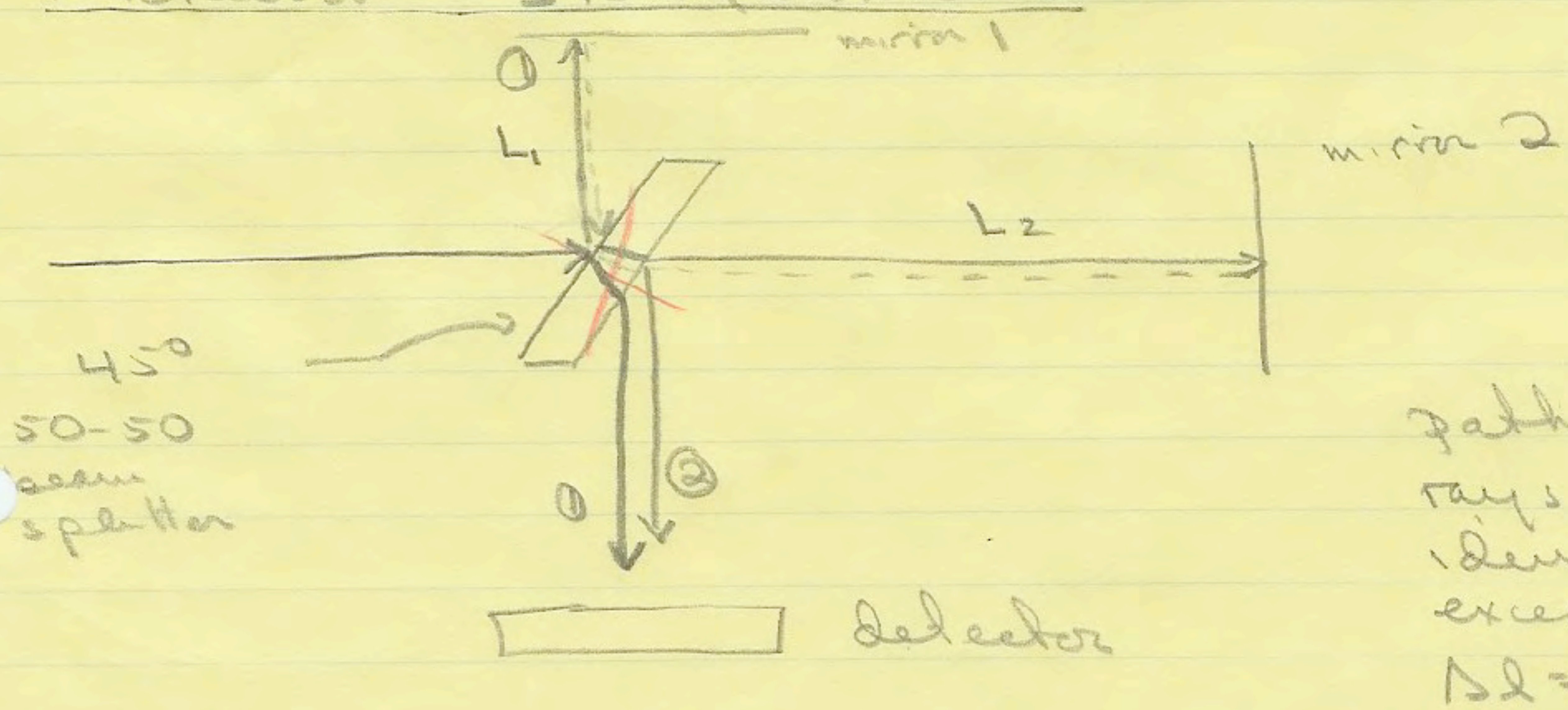
$$\Delta y \simeq r^2/2R$$

$$\frac{2\pi}{\lambda}(2\, r^2/2R) = (2n-1)\pi$$

maxima at $r = \sqrt{\left(\frac{2n-1}{2}\right)\lambda R}$ $\quad n \geq 1$

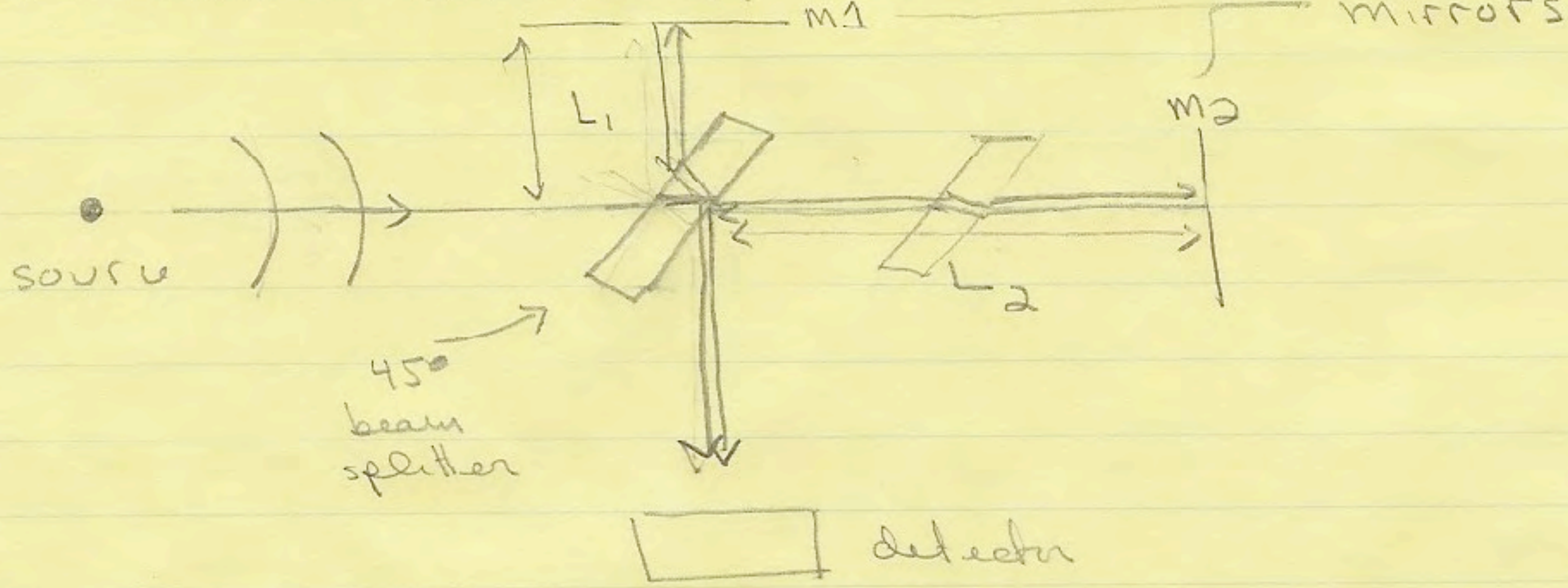
no maximum at center ($r=0$)

Michelson Interferometer

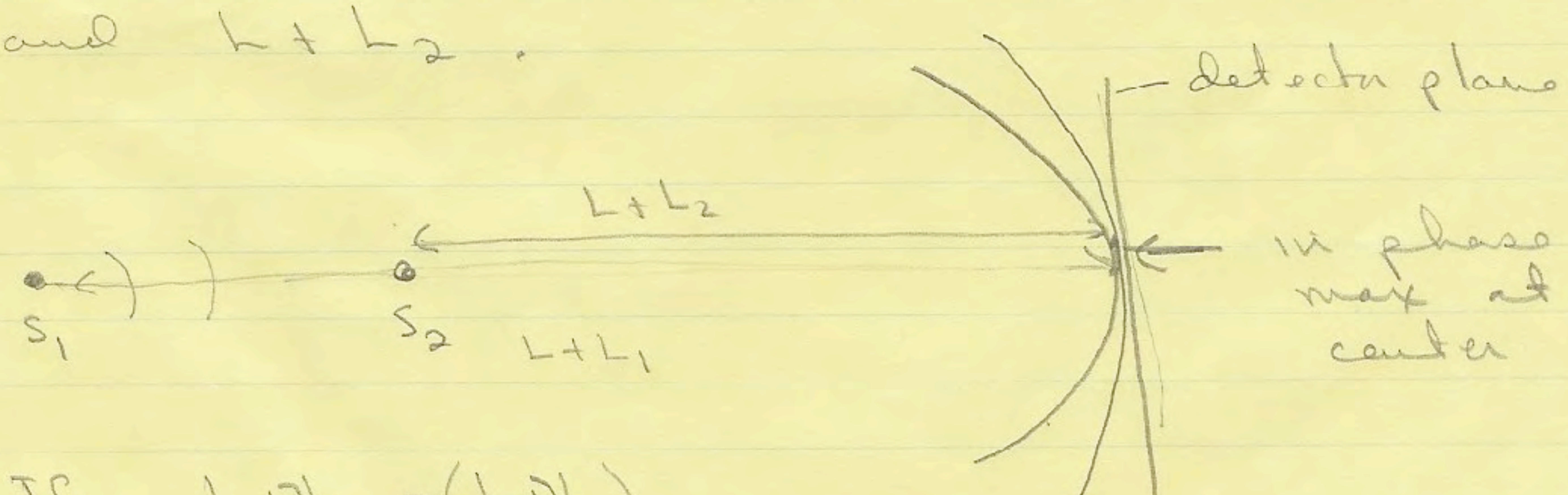


paths of rays are identical except for $\Delta\ell = 2(L_1 - L_2)$

Michelson Interferometer



The effect at the detector is the superposition of 2 waves originating from sources at distances $L + L_1$ and $L + L_2$.



If $L + 2L_1 - (L + 2L_2)$
$= 2(L_2 - L_1) = 2\pi m\lambda$ then the two waves are in phase and have maximum at center

If $2(L_2 - L_1) = 2\pi(2m-1)\lambda$

then have out of phase addition at center in phase addition at some

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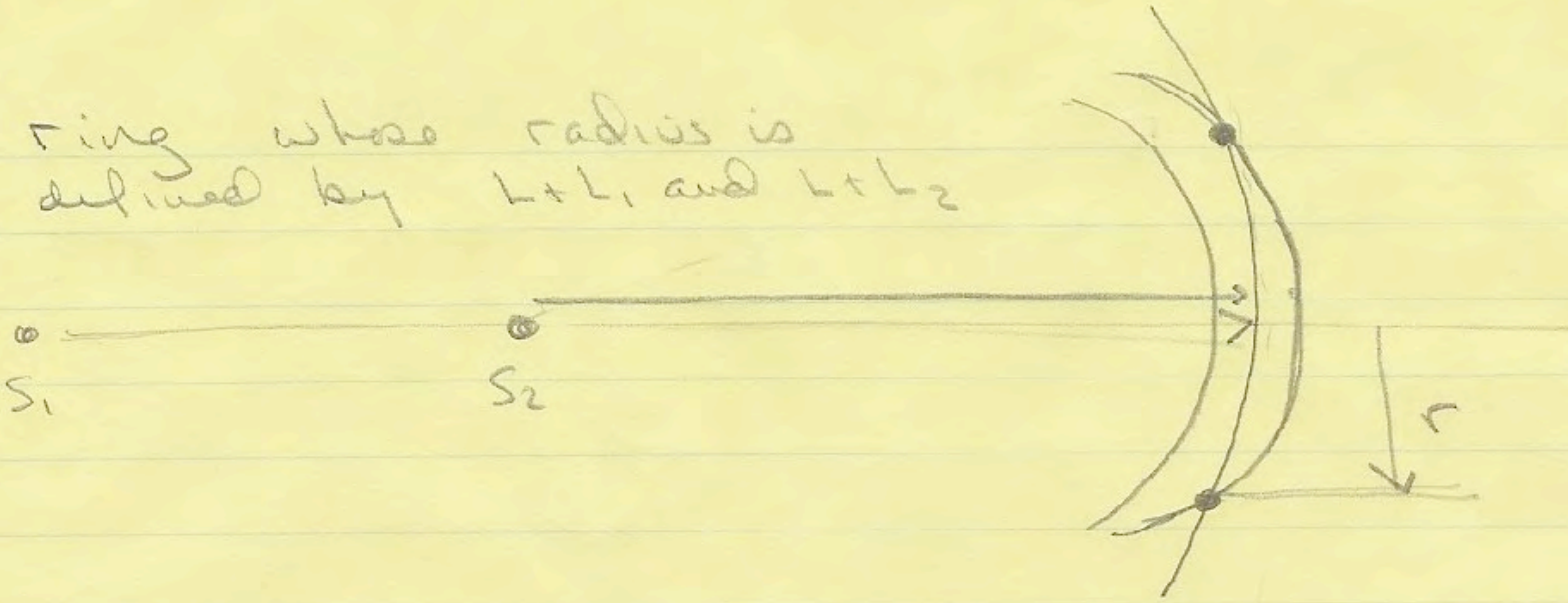
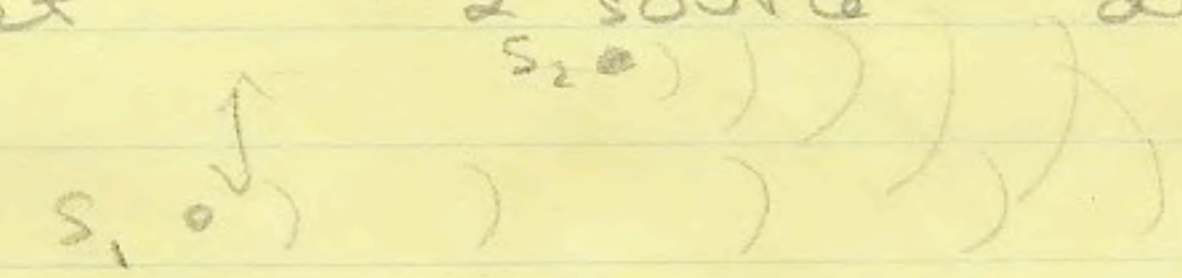
ring whose radius is defined by $L+L_1$ and $L+L_2$



radius of ring unimportant
Measure the change in $2(L_2-L_1)$ to find the spacing between adjacent maxima and thus λ

If tilt one of mirrors then two rays act like displaced point sources & get "2 source diffraction pattern"



Demo —

Diffraction

Previously said light through aperture gives spherical wave — true
Implicitly assume Intensity same in all directions not true

Understand qualitatively: the light is briefly slowed down by interaction with material of barrier. The closer to edge, the greater the Δv and thus the greater the $\Delta\phi$