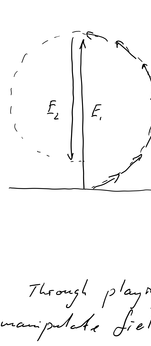
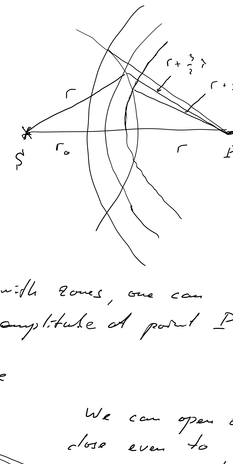
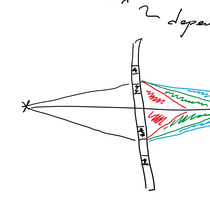




Through playing with zones, one can manipulate field amplitude at point P.

① Amplitude plate

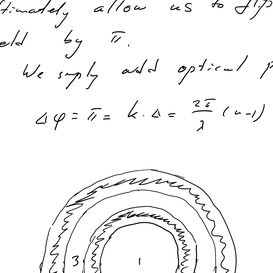


We can open or close even to increase amplitude of field in point P.

$$R_n = \sqrt{\frac{r r_0}{r + r_0} n\lambda} \Rightarrow \frac{1}{r} + \frac{1}{r_0} = \frac{n\lambda}{R_n^2} = \frac{1}{f}$$

↗ thin lens equation

$$f = \frac{R_n^2}{n\lambda}$$ ↘ dependent on λ!



Demonstration

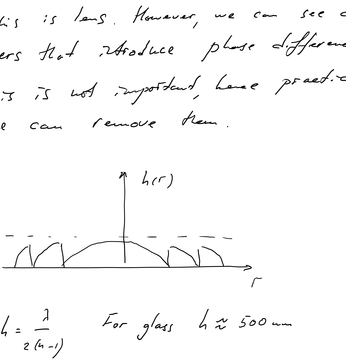
How also we can increase amplitude in point P?

Phase zone plate

We can introduce phase shift between zones increasing it even more. This will ultimately allow us to flip even zones field by π.

We simply add optical path difference

$$\Delta\varphi = \pi = k \cdot \Delta = \frac{2\pi}{\lambda}(n-1)h$$



We can increase amplitude in point P even more by straightening each single vector in first zone.

We can increase to $\frac{\pi}{2}$ times.

This is lens. However, we can see different layers that introduce phase difference 2π. This is not important, hence practically we can remove them.

$h = \frac{\lambda}{2(n-1)}$ For glass $h \approx 500$ nm