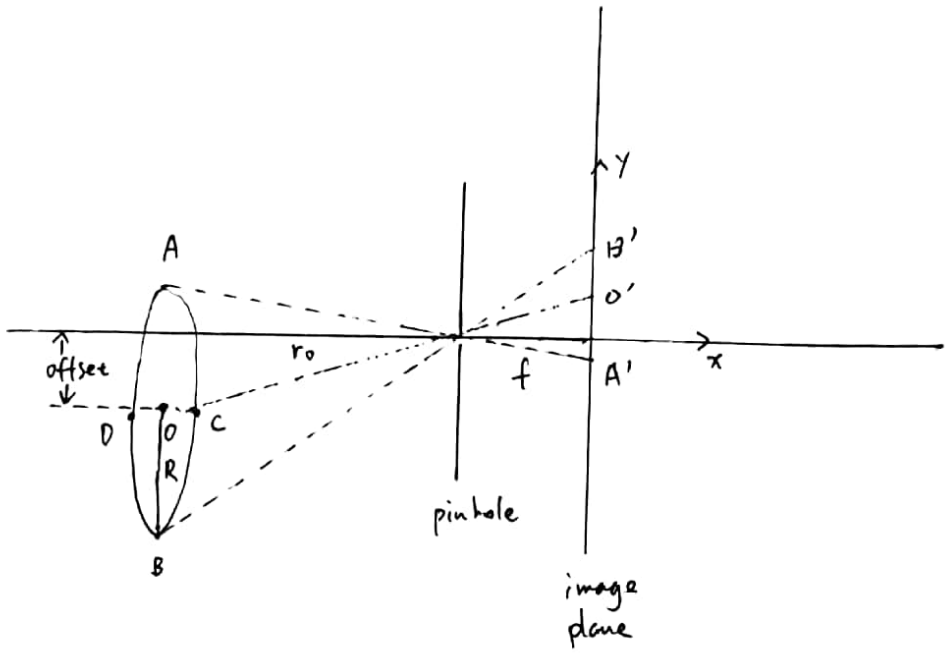
Youzhe Dou

P1

(a)



$$\frac{R+\text{offset}}{r_0} = \frac{Y_B'}{f} \text{ ①} \qquad \frac{\text{offset}}{r_0} = \frac{Y_0'}{f} \text{ ②} \qquad \frac{R-\text{offset}}{r_0} = \frac{Y_A'}{f} \text{ ③}$$

① - ② $\frac{R}{r_0} = \frac{Y_B' - Y_0'}{f}$ = ② + ③ $\frac{Y_0' + Y_A'}{f}$

Therefore, all points on the edge of this disk will have proportional ($\frac{r_0}{f}$) distance to O' (on image plane) or O (on disk). ~~Therefore, the resulting image will still be a circle~~. However, ~~due to~~ because there is also an unknown offset (come into or out of the paper), so ~~OC = OA~~ OC = OA does not always hold. Therefore, the image form is circular (it can be oval or ellipse).

(b) diameter of disk = R. ~~= 1mm~~

$$\frac{R}{r_0} = \frac{R'}{f} \qquad R' = \frac{Rf}{r_0} \qquad \text{when } f' = 2f \qquad R' = \frac{2R}{r_0} f$$

$$\text{Area} = \pi r^2 = \pi R^2$$

$$\text{Area}' = \pi R'^2 = (2R)^2 \pi$$

$$= 4\pi R^2$$

$$= 4\text{mm}^2$$

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C). it will still be a circle. The shape of the image on the image plane is only determined by the edge point on the object. Since sphere has edge points with same distance from the centre, it will always be a circle.

2. $Ax + By + Cz + D = 0$

A line in 3D space is $L = Q + \lambda L$

~~$L = (f\frac{Lx}{Lz}, f\frac{Ly}{Lz})$~~

Vanishing point $= \lim_{\lambda \to \infty} L = (f\frac{Lx}{Lz}, f\frac{Ly}{Lz})$

$= (f\frac{-C}{A}, f\frac{-C}{B})$