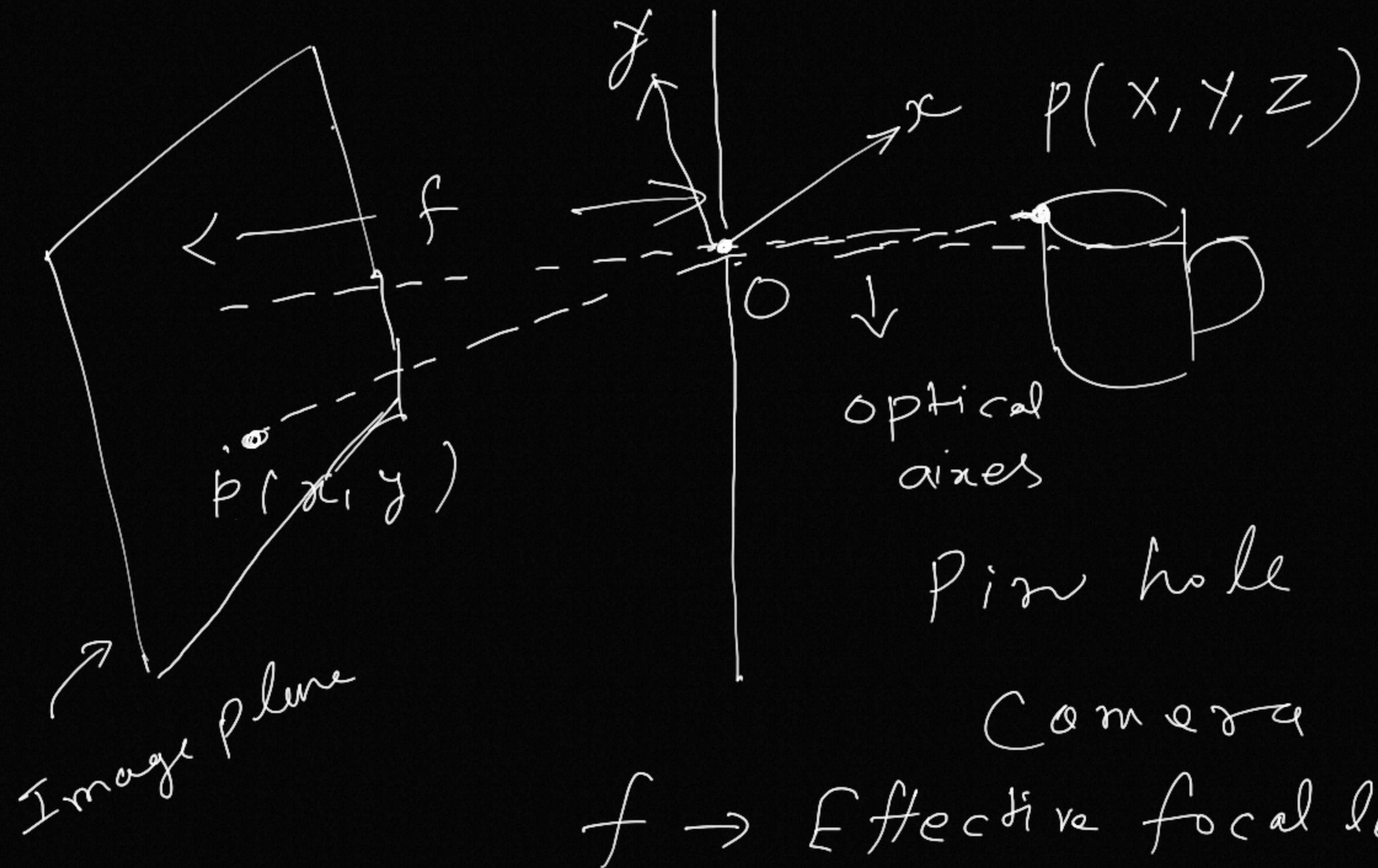


Image formation

Projection of 3D points onto 2D plane

- Geometric Relation
- Photometric Relation



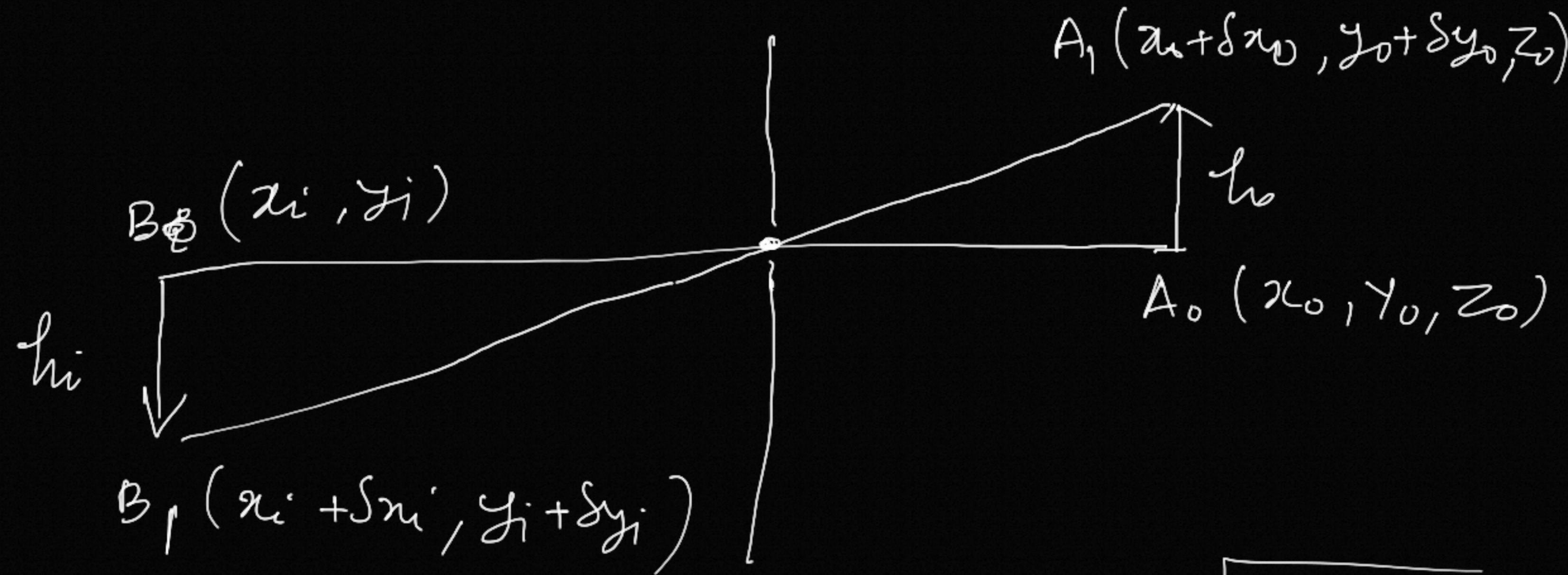
$P(x, y, z)$   
 $P(x_i, y_i, f.)$   
 $\vec{\gamma}_0$   
 $\vec{\gamma}_i$   
 $f$   
 $z$

$$\frac{\vec{\gamma}_0}{z} = \frac{\vec{\gamma}_i}{f}$$

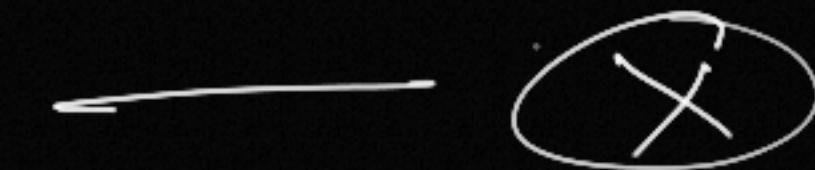
$$\frac{(x, y, z)}{z} = \frac{(x_i, y_i, f)}{f}$$

$$\frac{x_i}{f} = \frac{x}{z}, \quad \frac{y_i}{f} = \frac{y}{z}$$

$$(x_i, y_i) \rightarrow \left( f \frac{x}{z}, f \frac{y}{z} \right)$$



Magnification  $m = \frac{h_i}{h_0} = \frac{\sqrt{\delta x_i^2 + \delta y_i^2}}{\sqrt{\delta x_0^2 + \delta y_0^2}}$



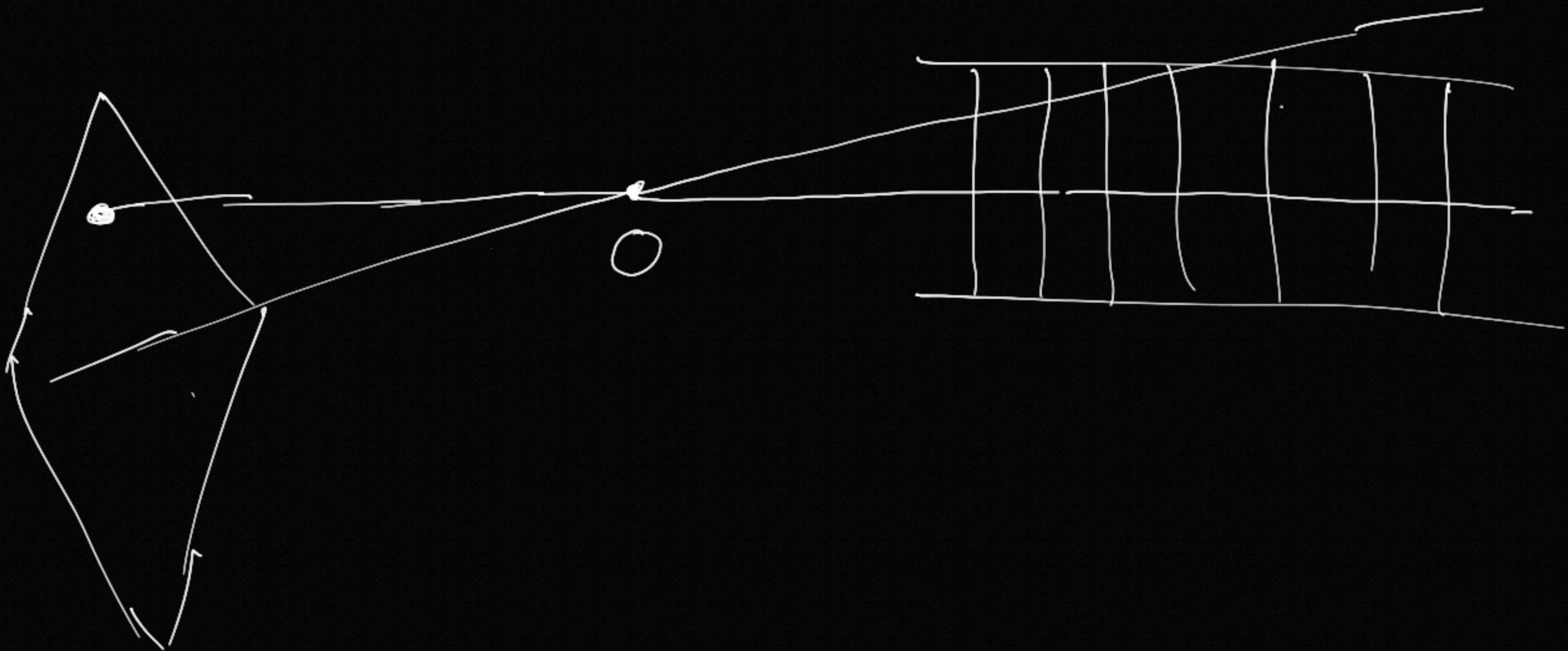
$$\frac{x_i}{f} = \frac{x_0}{z}, \frac{y_i}{f} = \frac{y_0}{z} \quad \text{--- A}$$

$$\frac{x_i + s_{xi}}{f} = \frac{x_0 + s_{x0}}{z}, \frac{y_i + s_{yi}}{f} = \frac{y_0 + s_{y0}}{z}$$

$$\frac{s_{xi}}{f} = \frac{s_{x0}}{z}, \frac{s_{yi}}{f} = \frac{s_{y0}}{z}$$

$$m = \frac{f}{z_0}$$

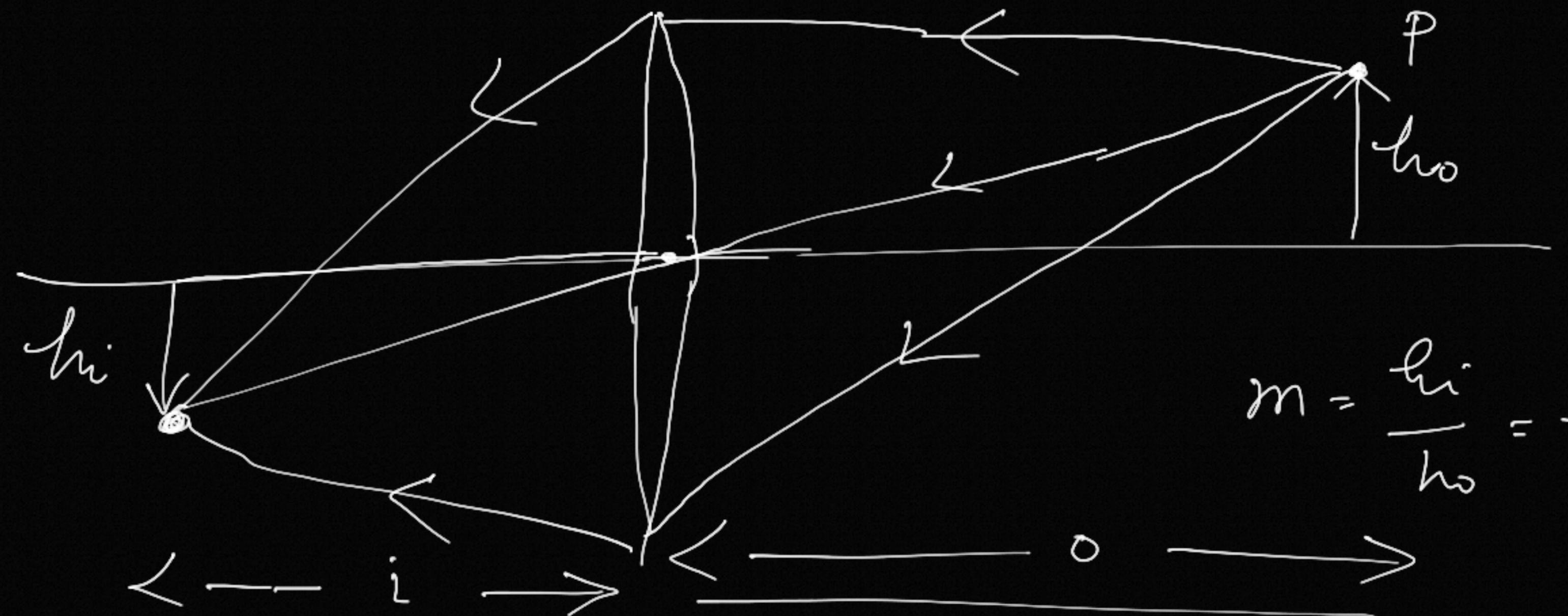
# Vanishing Point



What is ideal size of pinhole?

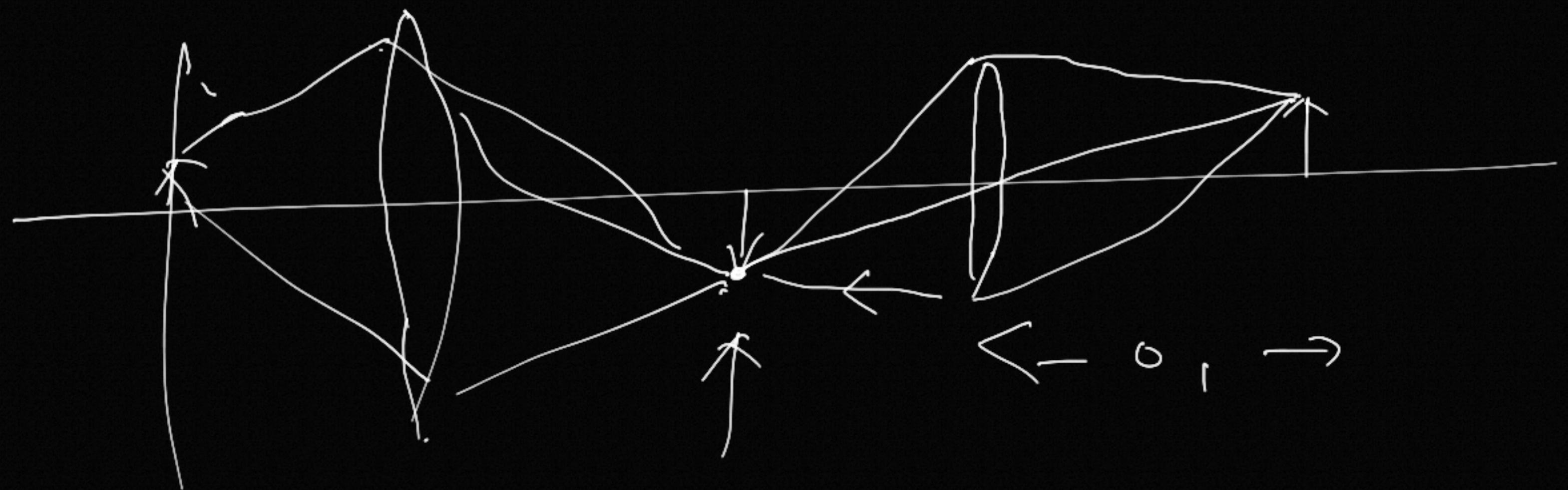
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lens :-



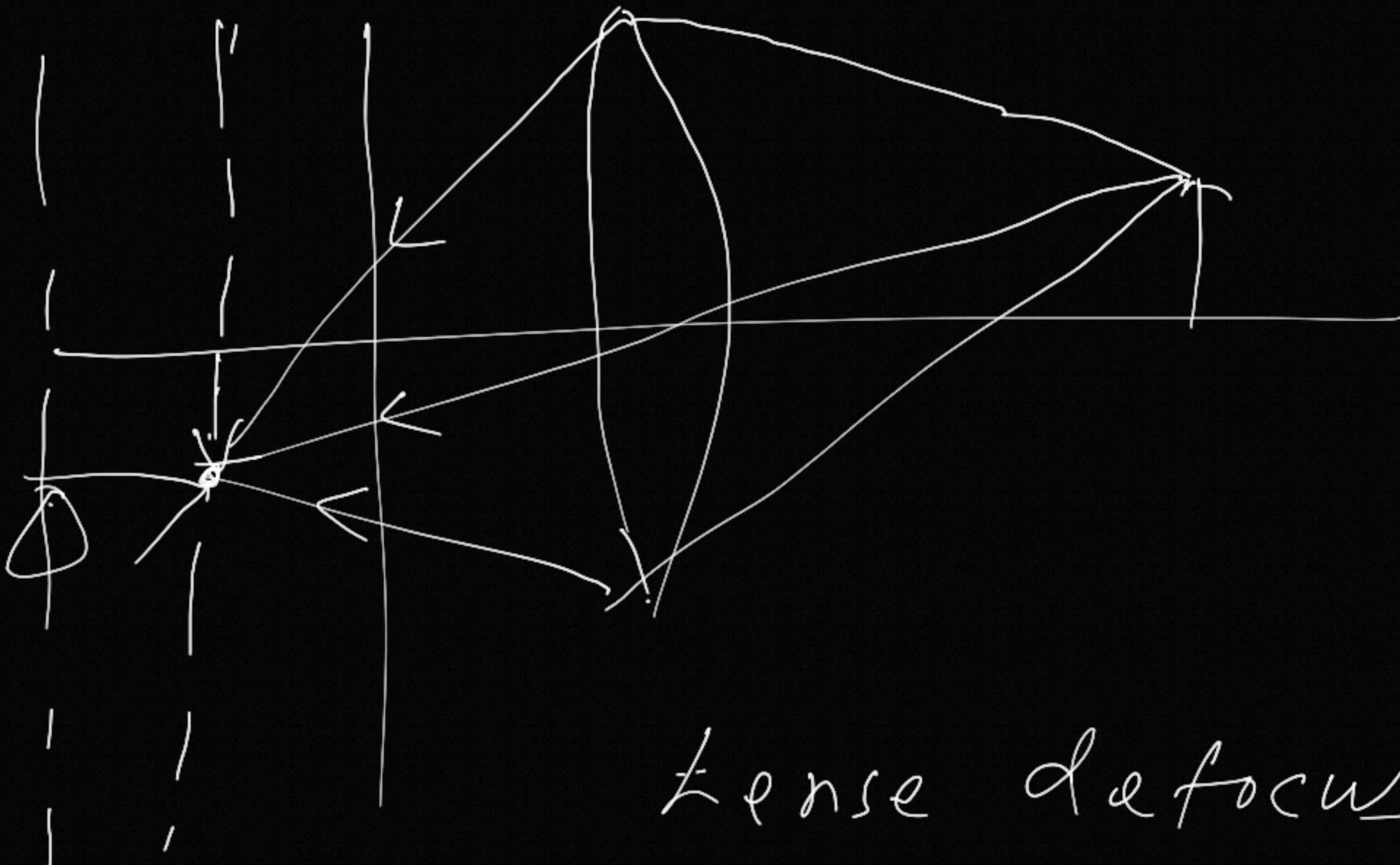
$$m = \frac{h_i}{h_o} = -\frac{i}{o}$$

$$\left( \frac{1}{f} = \frac{1}{i} + \frac{1}{o} \right)$$



|

|



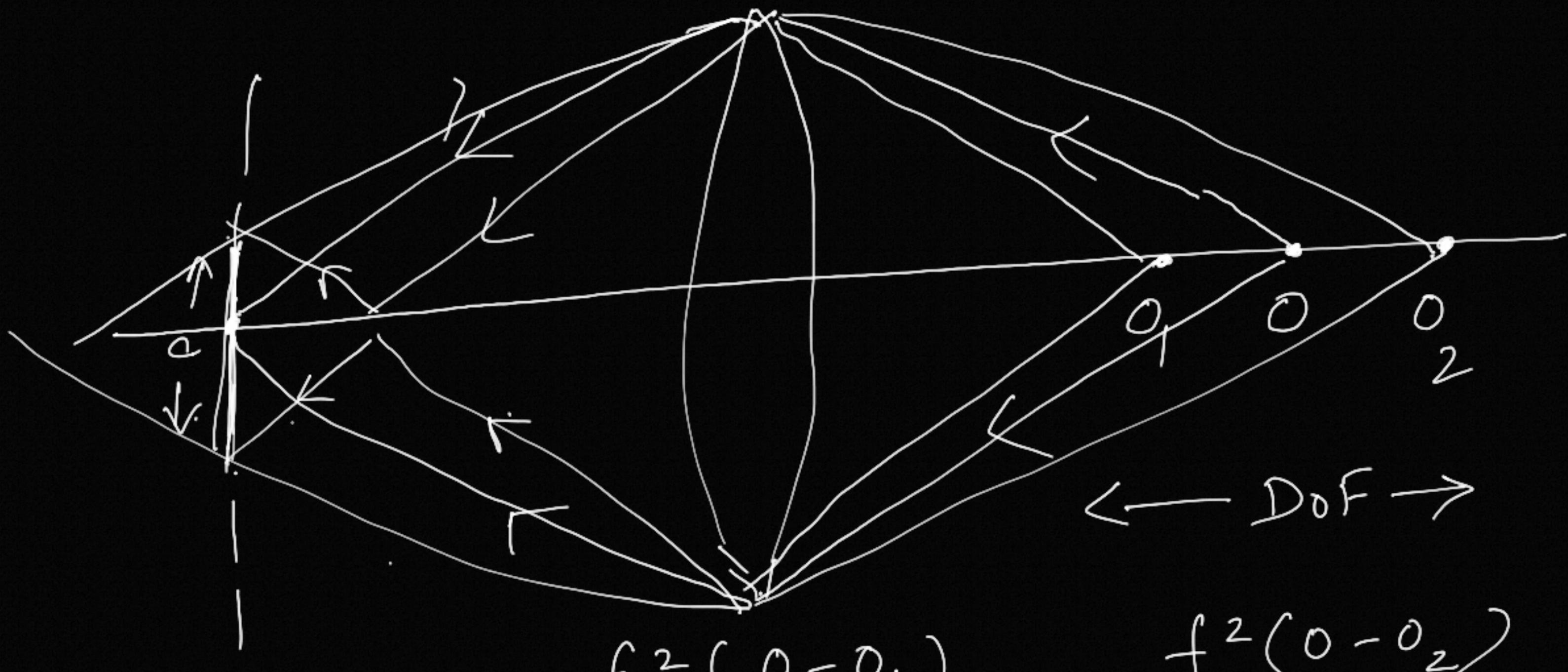
Lense defocus

$$\text{Aperture } D = \frac{f}{N}$$

$f \rightarrow$  focal length

$N \rightarrow$  f-Number

# Depth of field (DoF)



$$c = \frac{f^2(O - O_1)}{N O_1 (O - f)}, \quad c = \frac{f^2(O - O_2)}{N O_2 (O - f)}$$

- Transformation
- Camera properties
- Stereo
  - Single view
  - multi-View geometry.