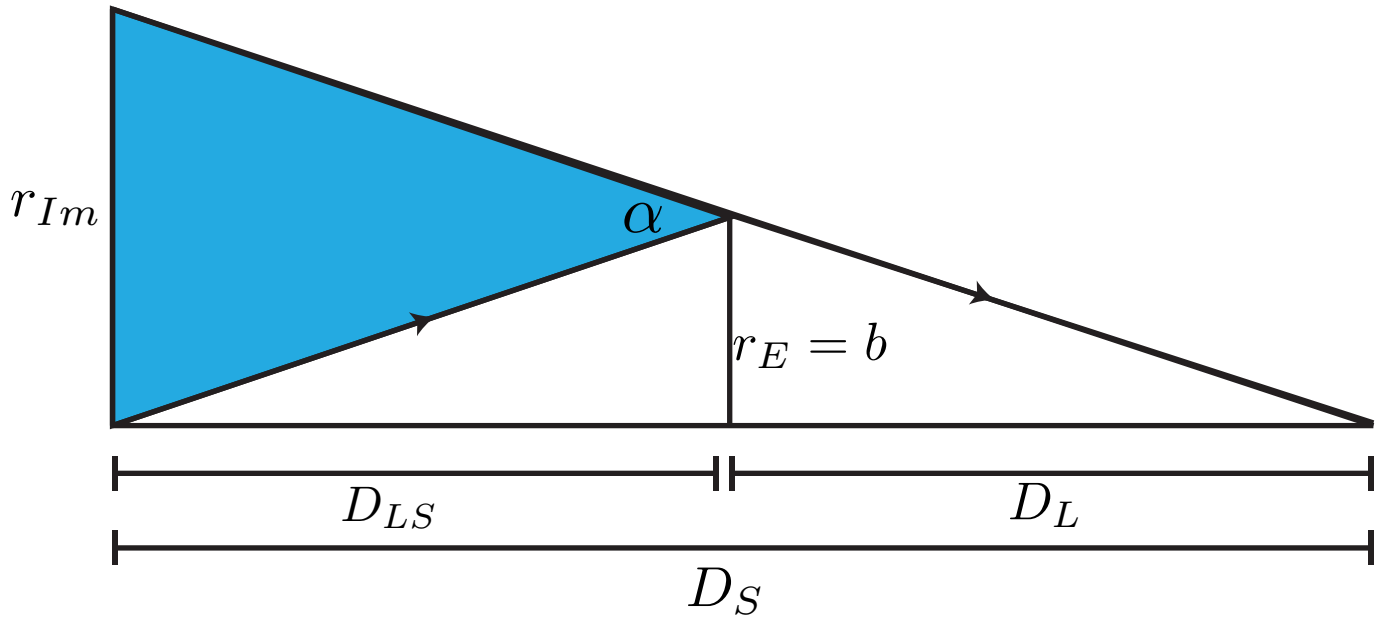


Derivation of Einstein Ring Equation



By similar triangles,
$$\frac{r_{Im}}{D_S} = \frac{r_E}{D_L} \quad (1)$$

When D_{LS} is comparable to D_L , the blue triangle is isosceles and for small angles,

$$\alpha \approx \frac{r_{Im}}{D_{LS}} \quad (2)$$

Combining eq. (1), (2) gives:
$$r_E = \alpha \frac{D_L D_{LS}}{D_S}$$

Using the equation for the deflection angle

$$\alpha = \frac{4GM}{bc^2} \quad \text{with} \quad r_E = b \quad \text{gives:}$$

$$r_E = \sqrt{\frac{4GM}{c^2} \frac{D_{LS} D_L}{D_S}}$$