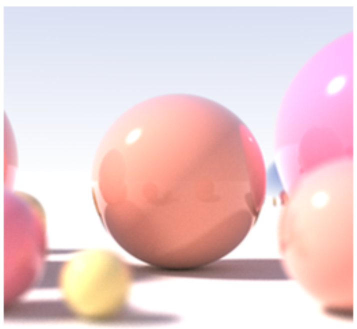
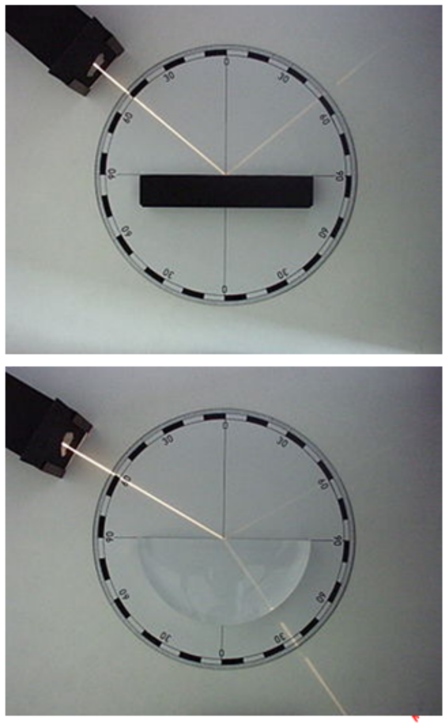
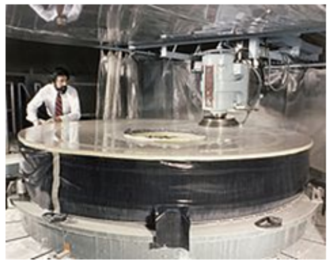
Geometric Optics

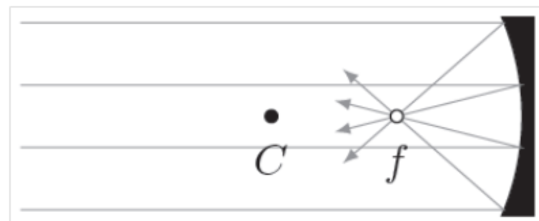
Geometric optics ignores the wave nature of light and is based on geometric laws



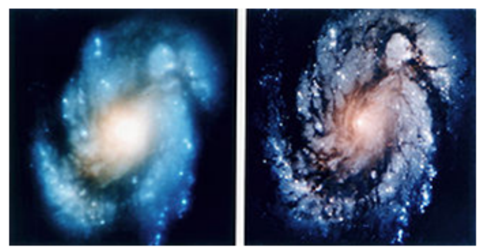


A curved mirror will act as a lens creating a magnified image based on its focal length

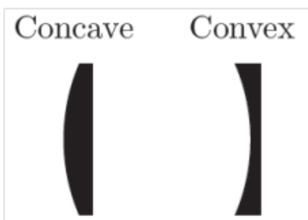


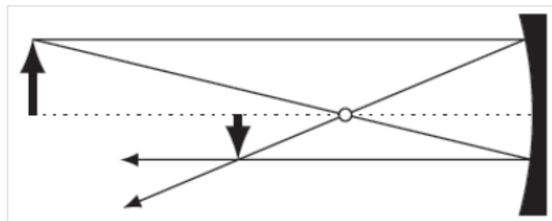


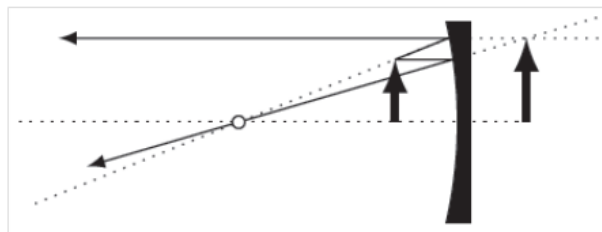
$$f = R/2$$



In a ray diagram, we only need a few key rays to identify the image location







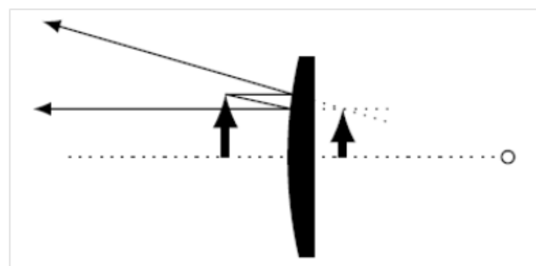
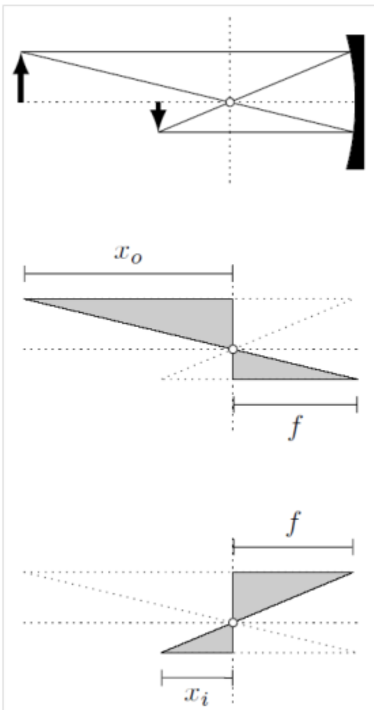


Image distance and magnification is related to object distance and lens focal length



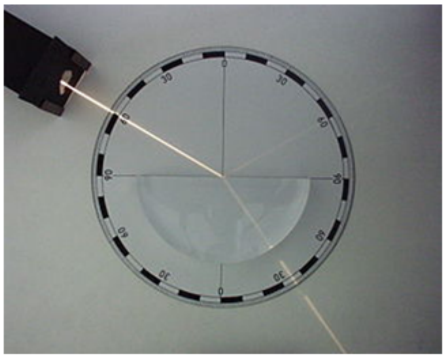
$$x_o x_i = f^2$$

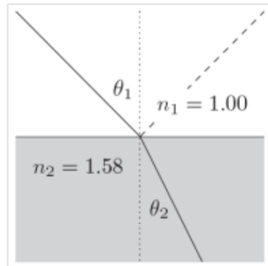
$$\frac{h_i}{h_o} = \frac{f}{x_o}$$

$$\frac{h_i}{h_o} = \frac{x_i}{f}$$

$$\boxed{\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f} \qquad m = \frac{h_i}{h_o} = -\frac{d_i}{d_o}}$$

Snell's law governs the angles involved in refraction and is related to the speed of light

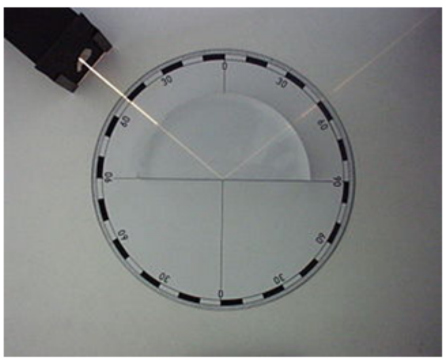


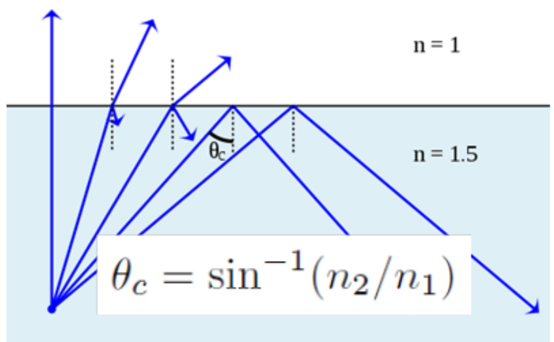


$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

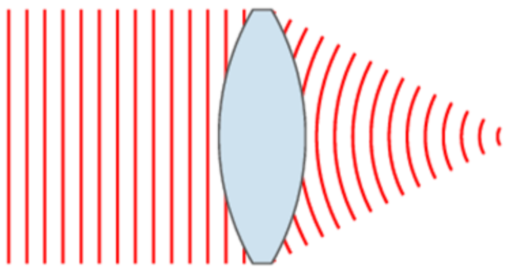
$$v = c/n$$

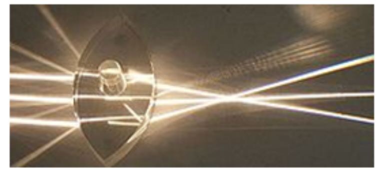
$$c = 3 \times 10^8 \text{ m/s}$$

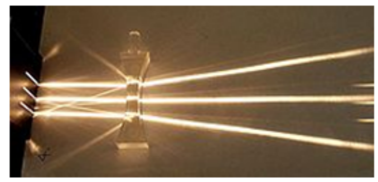




Transparent lenses obey same geometric formulas with a different sign convention

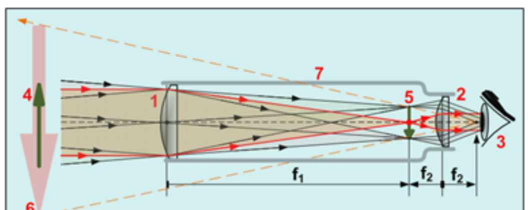






$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$

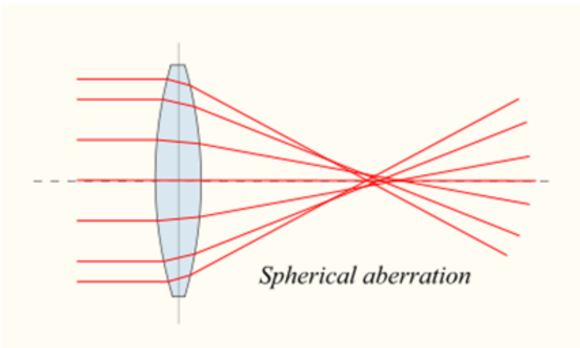
$$m = \frac{h_i}{h_o} = -\frac{d_i}{d_o}$$

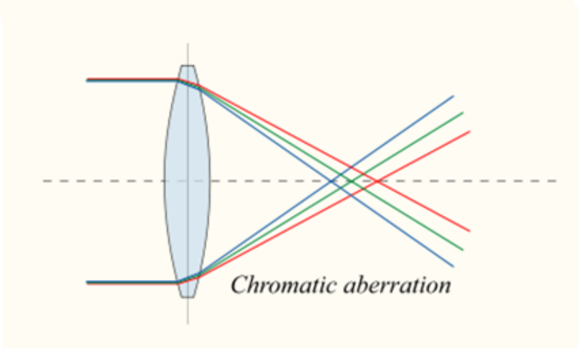


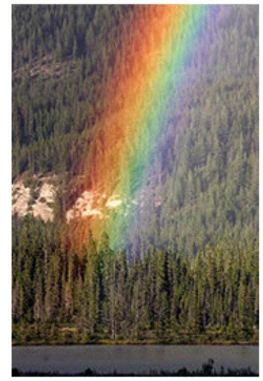
Schematic of **Keplerian** refracting telescope.

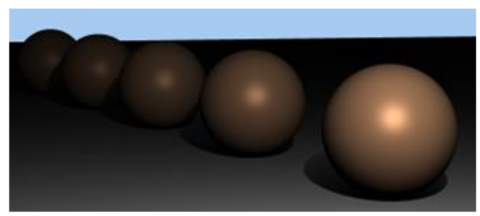
$$m = f_{\rm obj}/f_{\rm eye}$$

Most transparent materials are dispersive which explains prisms and rainbows









Double refraction and the problem of polarization