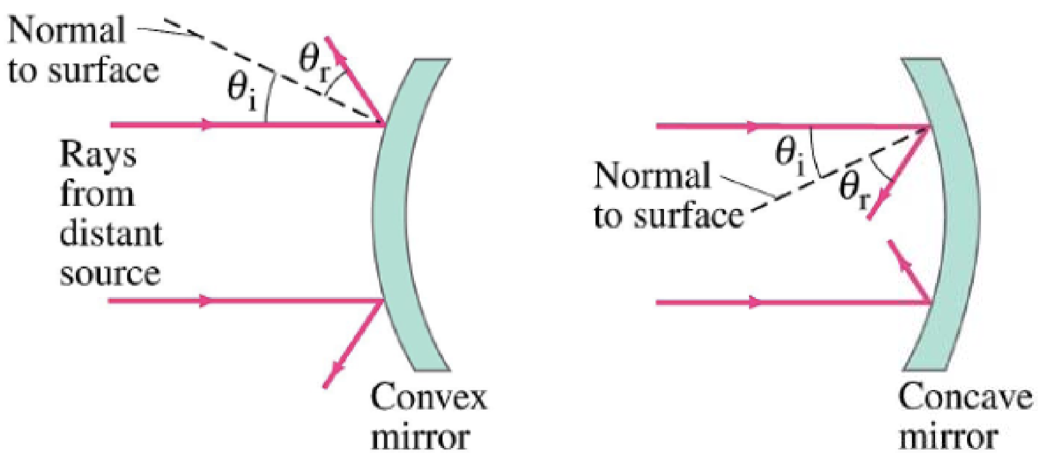
Physics 123 - March 18, 2013

Spherical mirrors



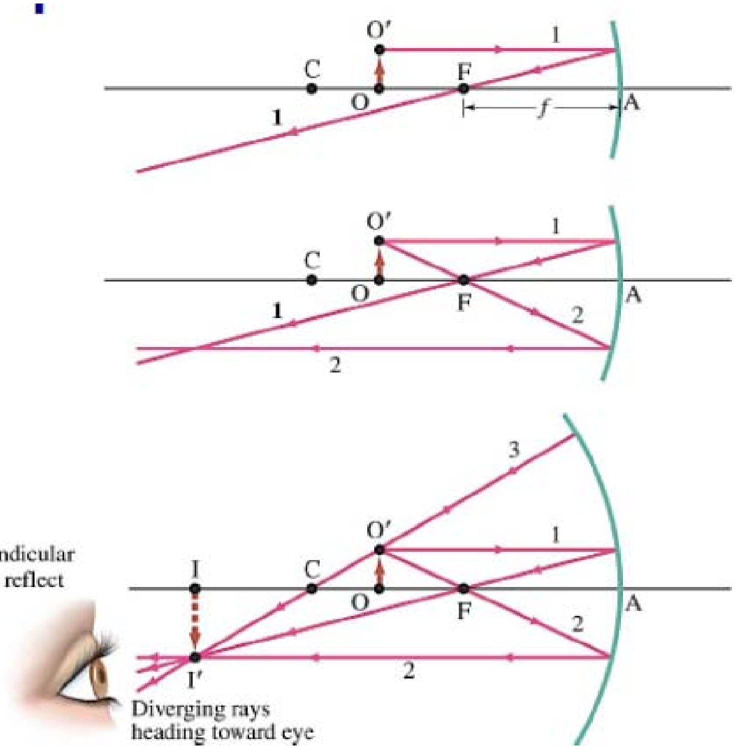
$$\boxed{\text{We will NOT cover spherical Mirrors in Phy 123. Rather similar to thin lenses}}$$

Ray Tracing – Spherical Mirrors

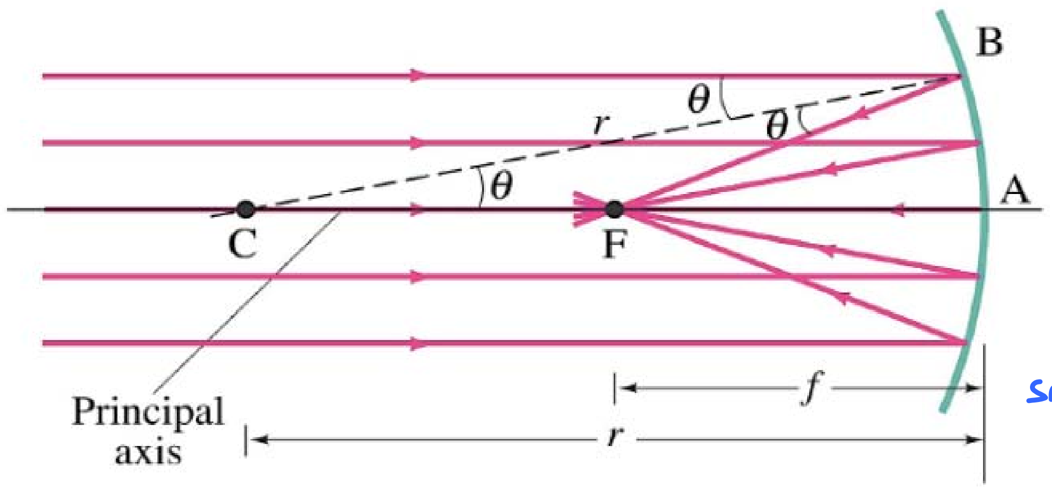
(a) Ray 1 goes out from O′ parallel to the axis and reflects through F.

(b) Ray 2 goes through F and then reflects back parallel to the axis.

(c) Ray 3 is chosen perpendicular to mirror, and so must reflect back on itself and go through C (center of curvature).

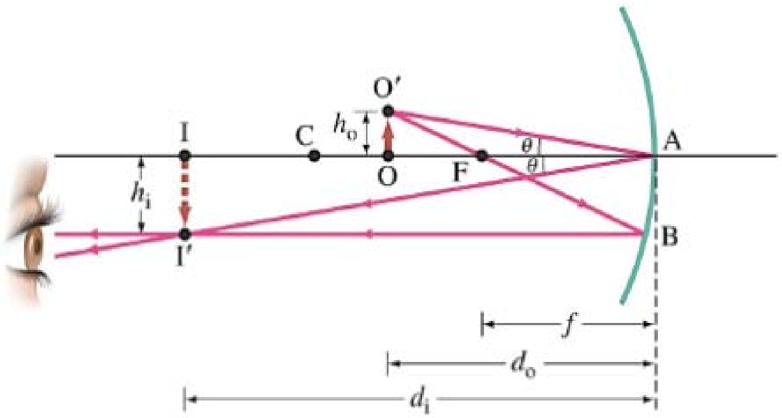


Source Far away



Small curvature

$f = r/2$



Mirror Equation

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

$$\boxed{\text{magnification, } m \equiv \frac{h_i}{h_o} = -\frac{d_i}{d_o}}$$

image inverted

Physical optics - Interference + Diffraction

Light ain't just rays

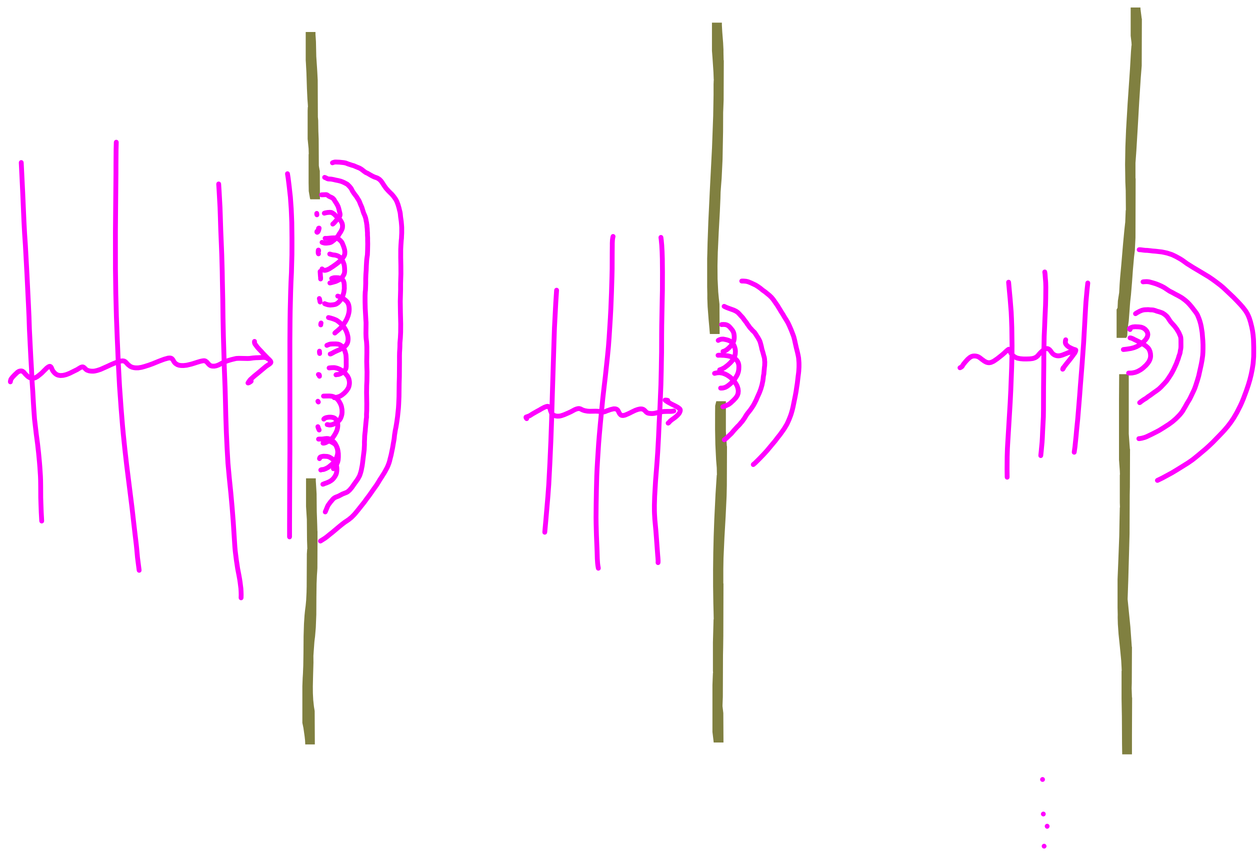
Christiaan Huygens
1629 - 1695
Dutch

Huygens w/ a
little spit in
the Middle

Huygens-Fresnel principle

Every unobstructed
point in a wavefront,
at a given instant in
time, acts as a
source of secondary
spherical wavelets

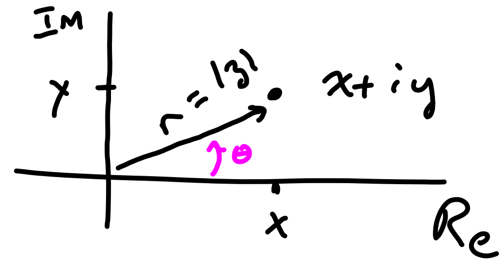
gouda



Complex representation of waves

complex # $z = x + iy$

$i = \sqrt{-1}$



x, y both real

$z = x + iy = r\cos\theta + r\, i \sin\theta$

$e^{i\theta} = \cos\theta + i\sin\theta$ Euler formula

$z = re^{i\theta}$

$|z|$

phase angle of z

$z^* \equiv$ complex conjugate of z

replace "i" with "-i"

$$z^* = re^{-i\theta} = x - iy = r(\cos\theta - i\sin\theta)$$

$$z_1 \pm z_2 = (x_1 \pm x_2) + i(y_1 + y_2)$$

$$z_1 z_2 = r_1 r_2 e^{i(\theta_1 + \theta_2)}$$

$$z_1/z_2 = \left(\frac{r_1}{r_2}\right) e^{i(\theta_1 - \theta_2)}$$

$$|z| = (z z^*)^{1/2} = \sqrt{x^2+y^2}$$

$$(x+iy)(x-iy)$$

$$(x^2+y^2)$$

$$z = \mathrm{Re}(z) + i\,\mathrm{Im}(z)$$

$$\mathrm{Re}(z) = \frac{1}{2}(z+z^*) \qquad \mathrm{Im}(z) = \frac{1}{2i}(z-z^*)$$

$$\frac{1}{2}(x+iy+x-iy)$$

$$\mathrm{Re}(z) = r\cos\theta \qquad \mathrm{Im}(z) = r\sin\theta$$

$$\psi(x,t) = A\cos(kx-\omega t) = \mathrm{Re}\left[A\,e^{i(kx-\omega t)}\right]$$

$$= Ae^{i(kx-\omega t)}$$