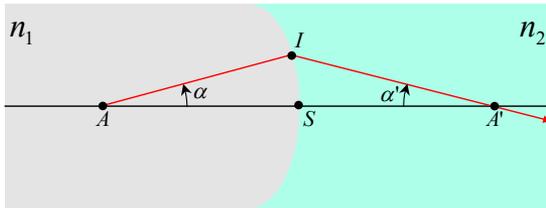# Stigmatic Surfaces

General Case

Definition of Stimatic

$$n_1 \overline{AI} + n_2 \overline{IA'} = k \qquad k > 0$$

Equation of Surface

$$n_1 \sqrt{(x-a)^2 + y^2} + n_2 \sqrt{(x+a)^2 + y^2} = k^2$$

Object/Image	Reflective Surface	Refractive Surface $n_1 > n_2$	$n_1 < n_2$
Real object on axis at infinity. Real image.	Parabolic	Hyperbolic	Elliptical
Real object on axis at infinity. Virtual image.	Parabolic	Hyperbolic	Elliptical
Real object, real image.	Elliptical $\ell + \ell' = 2a$	Spherical — Object and image at focal point	
Virtual object, virtual image.	Elliptical $\ell + \ell' = 2a$	Objects and images located anywhere on surface	
Real object, Virtual image.	Hyperbolic	Spherical — Aplanatic Points	$x = R\left(1 + \dfrac{n_2}{n_1}\right)$
Virtual object, Real image.	Hyperbolic	Spherical — Aplanatic Points $x' = R\left(1 + \dfrac{n_1}{n_2}\right)$	